FOOD MANUFACTURE

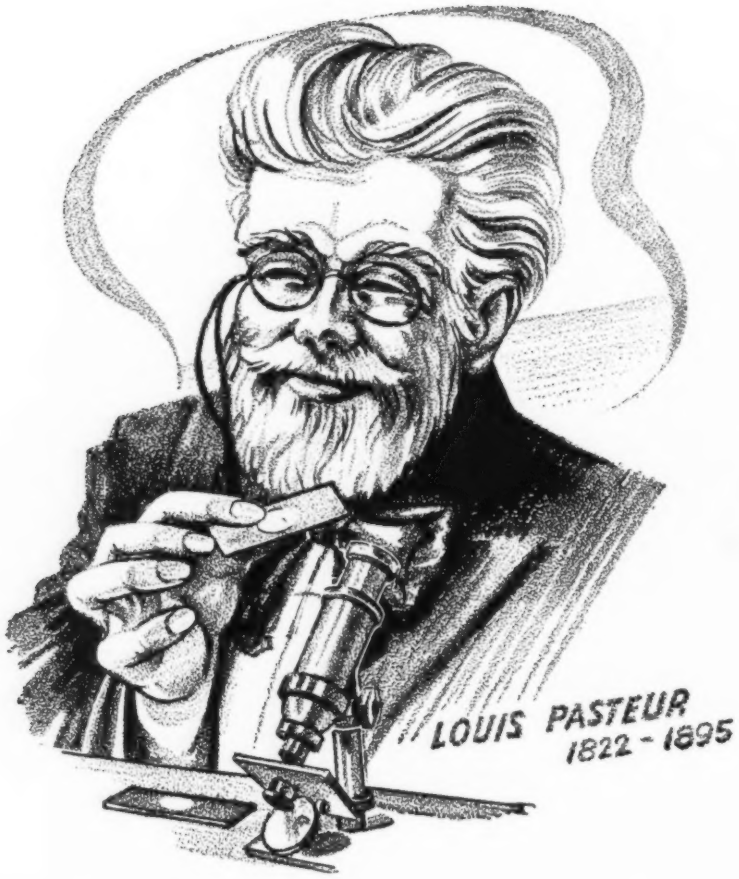
ISHERS: LEONARD HILL LIMITED, 17, STRATFORD PLACE, LONDON, W. 1 MARCH, 19

The ideal metal for food processing

"STAYBRITE'
REG° TRADE MARK
SUPER STAINLESS STEEL

IRTH-VICKERS STAINLESS STEELS LTD SHEFFIELD

PIONEERS



PASTEURIZATION—the word is so familiar that few of us spare time to think of the work that Pasteur did in the elimination of disease. Standards of hygiene are so high to-day that we accept them as a matter of course.

May we remind you, then, that when you use MONO Containers, you are dealing with a firm who have made a study of hygienic packing for over 30 years, and whose trade mark "MONOCON" has set a standard in containers throughout the world.

MONO CONTAINERS

MONO CONTAINERS LTD., PARK ROYAL, LONDON, N.W. 10 WILLESDEN 0900 (8 lines)

Irish Factory: Inchicore, Dublin

A JOURNAL DEVOTED TO THE PRODUCTION AND MANUFACTURE OF ALL EDIBLE COMMODITIES INVOLVING A PROCESS OF MANUFACTURE.

FOOD MANUFACTURE

Incorporating Canning, Packing and Preserving.

VOLUME . . . XIV

NUMBER . . . 3

MARCH . 1939

CONSTRUCTORS

STEEL CLOTHES LOCKERS

ERDINGTON · BIRMINGHAM 24

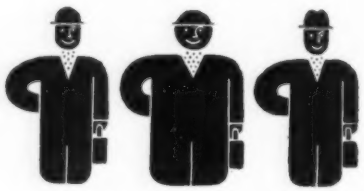
CONTENTS

	PAGE
Editor's Comments	75
The Processing of Ice-Cream Mixes. *L. J. Hynes*	79
Kippers in Cold Storage. *Dr. A. Banks, Ph.D.(Liverpool), A.I.C.*	83
Chemical and Bacteriological Standards for Ice-Cream. *Eric Humphriss, A.I.C., F.R.M.S.*	86
Air Conditioning and the Food Industry	88
British Refrigeration Experts Discuss Methods of Quick Freezing	91
Chemical Engineers' Annual Dinner	94
Artificial Sausage Skins. *Specially Contributed*	95
Food Poisoning. *Elliot B. Dewberry, M.R.I.P.H., M.R.San.I.*	97
Book Reviews	101
News from the Industry	103
Obituary	106
Information and Advice	107
Recent Patents	109
New Companies and Trade Marks	110

Published on the first day of every month by Leonard Hill Limited, 17, Stratford Place, London, W.1. Telephone: Mayfair 7383 (Private Branch Exchange). Annual Subscription, 10s.; Abroad, 12s. 6d.; Single copies, 1s.

The Editor will be glad to consider contributions from those engaged in the Food Industry. Articles intended for publication should be of a practical nature and accompanied by photographs or drawings when possible.

We don't need any salary



THREE NEW SALESMEN

TO PUT NEW VITALITY INTO **RETAIL DISTRIBUTION**

I'm T.P. 'Trade Press' advertising, one of the 'extras' that advertisers are getting from advertising in the Radio Times. My plan works this way. Advertisements from the Radio Times are reproduced regularly in the appropriate trade paper to remind the retailer that, by stocking your product and displaying it well, he will make the most of the demand your campaign creates. Of course, I co-operate with Sales Managers, Advertising Managers and Agents. The advertising will appear at the best time and in the best possible publications for linking up closely with your main sales efforts. And naturally I always include the full Radio Times List of advertisers in every announcement. Well, there's my particular job—**and I don't cost you a penny.**

I'm P.R. a 'Poster Reproduction' of your Radio Times advertisements. You can have as many of my posters as you like, to mail to your retailers as window-bills. This will remind your customers of your message both effectively and economically when they are at the shops. **My services are available to you at half-cost.**

I'm D.M. 'Direct Mail' advertising, and I've got a very novel technique. I will arrange to have your letters to the trade duplicated on Radio Times letter-paper. I'll get the Advertisement Director of B.B.C. Publications to sign them and send them to you with his own envelopes, ready for mailing to your private list of retailers. I'm sure this will guarantee a thorough reading! **And I also work for you at half-cost.** For complete information about the co-operation we all offer you just write to—Advertisement Director, B.B.C. Publications, Dept F.M 35 Marylebone High St., London, W.1.

WE'RE JUST A PART OF YOUR ADVERTISING IN THE

RADIO TIMES

3,000,000 guaranteed weekly net sale *Member of the Audit Bureau of Circulations*

FOOD MANUFACTURE

Vol. XIV, No. 3 March, 1939

Deleterious Foodstuffs

WHEN FOODSTUFFS are sold, there is always an implied warranty that the food is fit for human consumption, nor can the absence of any negligence on the part of the seller displace the warranty. Such a warranty will be implied under the Sale of Goods Act, 1893, but the only person who is entitled to avail himself of the breach is the purchaser.

In such circumstances, moreover, the seller may not only be made liable in damages in a Common Law action brought against him by the purchaser, but he may also be liable to a penalty under the Food and Drugs (Adulteration) Act, 1928. That Act, by S. 2 (1), makes it an offence for a person to sell to the prejudice of the purchaser any article of food or any drug which is not of the nature or not of the substance, or not of the quality of the article demanded by the purchaser.

The question that arises, however, is as to whether it is possible for third parties, who suffer damage through the consumption of deleterious foodstuffs sold to a purchaser, to recover damages against the suer.

No such action will lie under the Sale of Goods Act, 1893, at the suit of third persons, and if such persons are entitled to recover damages it can only be, it seems, for a breach of statutory duty.

Infected Milk Case

In our June, 1938, issue we commented on an action, Square v. Model Farm Dairies (Bournemouth), Ltd., which was brought against a dairy in respect of injury suffered by members of the purchaser's family in consequence of the consumption of milk which, through no fault on the part of the dairy, unfortunately became infected with typhoid.

Mr. Justice Lewis, who tried the case, came to the conclusion that the dairy was liable to the members of the purchaser's family on the ground of breach of statutory duty; the statutory duty being imposed on the dairy by the above-mentioned provisions of the Food and Drugs (Adulteration) Act, 1928.

The Court of Appeal, however, have now held that no such statutory duty at all was imposed by the Act as far as third persons are concerned, and that the members of the purchaser's family accordingly had no cause of action. The grounds of this decision are of some interest.

It should be noted that it is not every breach of statutory duty which will entitle an injured party to recover damages in a civil action. The Court of Appeal pointed out that there is an important distinction between, on the one hand, duties which did not exist at Common Law but are entirely the creation of statute, as some of the duties on factory owners imposed for the first time under the original Factory and Workshops Act, 1901, and on the other hand, duties which already exist at Common Law, but are subsequently made the subject of penalties by statute.

The Court of Appeal were of opinion that the duty imposed by S. 2 (1) of the Food and Drugs (Adulteration) Act, 1928, came within the latter category of statutory duties. There was a penalty provided for the breach, and no right to bring a civil action for damages in respect of the breach accordingly arose.

Furthermore, they pointed out that it is only the person for whose benefit the duty is imposed by the statute who is entitled, if at all, to bring a civil action for damages. In their opinion the above statutory provision was intended only for the benefit of the purchaser, so that there was no duty towards third persons. On this ground as well the members of the purchaser's family were prevented from recovering any damages.

Changing the Pilot

The Ministry of Agriculture is indeed a troubled sea, full of swift, silent currents, wild storms and dangerous rocks, and many a pilot has gone under in trying to steer the ship of agriculture through its dangers. To begin with he has a poor crew. The English farmer is a disgruntled creature who seems to practise the doctrine of " never be satisfied ". He very seldom knows his own mind or what he wants, but what he gets is usually wrong. Without due consideration or deliberation he

rushes into schemes put forward by guileful boards and other organised bureaucracies, only to find himself worse off than before and a prisoner in his own house.

Ever since the Agricultural Marketing Acts and the ill-fated dabblings of Dr. Addison into agriculture's problems, the state of the British farmer has been getting worse and worse. All that the Marketing Boards have done is to confuse the farmer with returns and forms and regulations and restrictions, leaving him worse off. We agree that the middleman section has profited at the expense of the farmer and consumer, but that does not help agriculture. Ministers have tried to tackle the problem according to the principles of politics, and have failed miserably. Such able men as Mr. Elliot and Mr. Morrison have crashed on the rocks simply because they relied on the half-baked policies handed to them by their predecessors at the Ministry.

Now Sir Reginald Dorman-Smith is taking the helm, and we wish him God-speed. His new task is no easy one—no sinecure—and if he follows in the paths of his predecessors his end will come as swiftly and surely. Our views on agricultural policy have been expressed so often that there is no need for repetition. The whole outlook must change. Subsidies must cease and markets created by keeping out foreign supplies by high import duties, the proceeds of which should go back to the farming industry to help improve methods and conditions. Handing out further doles is no good, being merely useless palliatives instead of healing medicine. Will Sir Reginald prove the good sound doctor, or yet another quack? We do not know, but he certainly has his work cut out.

National Nutrition Conference

We referred last month to the New Nutrition Panel set up by the Food Group of the Society of Chemical Industry. Further evidence of the widespread interest in problems of nutrition is provided by the decision of the Council of the British Medical Association, at its meeting at the end of January, to call a national conference on nutrition in its wider aspects, that is, in relation to national policy. This national policy also includes agriculture.

The Conference, which will last for three days, has been provisionally fixed to begin on April 27. It is to be a representative one, consisting not only of medical men but also agricultural producers, home and overseas, and representatives of industry and education. Many interested bodies are being invited to send delegates, and we hope that the Food Group's nutritional panel will take part.

It is understood that the Conference will make as its starting point such recognised food needs of the individual as will maintain good health. Having accepted these, the next stage will be to answer the questions: how far are these needs satisfied in this country at present, and what increases are required in the production of certain foodstuffs, either at home or in the Empire, to fill the need? Means for increasing consumption of essentials must be considered, and the questions of education, reasoned propaganda and State aid will have to be studied.

It will be remembered that the B.M.A. appointed a special committee in 1933, under the chairmanship of Sir K. Le Fleming. Progress has been slow—it is a very complicated subject—but there are signs of more rapid moves now.

Nutritional Standards

The League of Nations has done much to stir up the investigation of the problems of nutrition in all countries. Let us be clear as to the origin of this. It was not started, as many people seem to believe, out of concern for the nutrition of the masses, noble though this conception may be. It was launched at the Assembly by the Australian delegation with the idea of relieving agricultural depression in food-producing countries. This, the original object, now seems completely engulfed by the interesting sociological aspects of the work, which has absorbed the attention of genuine nutritional specialists, medical practitioners and food faddists alike.

During the last few years a tremendous amount of data has been collated, and all this is embodied in a Survey of Nutritional Policies, 1937-38. The Assembly suggested that national nutrition committees, of which there are now more than twenty, should forward annual reports on action taken by them to study the state of nutrition in their respective countries and to improve nutritional standards. This Survey is the first of what will presumably be an annual summary.

Possibly the most interesting section deals with the milk consumption campaign in different countries, of which Finland appears to be the most milk conscious. In Helsinki the daily consumption is about two pints per head—a giant's quaff compared with most countries' modest sips. This survey, which also discusses economics and education, will prove a very useful little handbook to those who attend the National Conference in April to which we refer above.

Flour Storage

In the question of the keeping properties of flour and the frequent discussions one hears on the subject, it may be opportune to remind readers who are interested of a paper by Fisher, Halton and Carter in *Cereal Chemistry*, vol. xiv., March, 1937. This paper, to judge from many discrepant views one hears, has not met with sufficient recognition.

The paper described the results of an extensive investigation of the changes taking place in flour during 18 months' storage. Four different flours were studied: an ordinary English patent and an English low grade, a No. 3 Manitoba patent and low grade. Samples of each flour at three different moisture contents—approximately 12 per cent., 16 per cent. and 18 per cent.—were stored in closed tins. It had long been recognised that all flours improve in baking quality during storage up to a point, beyond which deterioration sets in. This deterioration, it has been stated, continues until the flour is quite unfit for bread making.

The initial improvement may continue to increase for several years in the case of high-grade Manitobas, while with softer flours like English a few months may be the limit of safe storage. Fisher and his colleagues' results showed the problem to be more complicated. After the first deterioration has proceeded for some time a second improvement sets in which, in turn, may be followed by a second deterioration. These changes are much more marked, and take place much more rapidly the higher the moisture content, and marked differences are shown according to the grade and nature of the flour.

Home Storage of Food

Considerable interest has been evinced by householders following the President of the Board of Trade's gracious dictum that there would be no objection to the accumulation in peace time of small reserves of suitable foodstuffs with a view to providing for eventualities.

Hence, larders may be filled without dire forebodings of unpleasant consequences. How the wise virgins would fare in war time—whether they would be forced to share their oil with the foolish ones—is a question that may well be left for the moment.

The Food Defence Department has compiled a list of articles which can be suitably stored for reserves, amongst which figure cocoa, tea, sugar, plain biscuits, flour, suet and canned meats and fish. As regards canned foods there has been issued the excellent booklet by the Canned Foods Advisory Bureau, which gives the householder a clear idea of the range and cost of canned foods.

In the Food Defence Department's list there is notable absence of the mention of dried vegetables and fruits and jam.

We feel that some guidance should be given with regard to the relative quantities of foods to be stored so that a proper balance be preserved. However, perhaps the powers that be do not consider that a week or so's unbalanced diet would do anyone any harm!

It is stated that flour and oatmeal will not keep fresh for longer than two months. If, however, the flour is milled dry and kept in sealed tins it lasts much longer, and a well-known firm of flour manufacturers is putting up self-raising flour in 4-lb. sealed tins with a guarantee of over a year.

Weight of Packed Goods

A case which cannot fail to interest manufacturers was heard on February 6 at Launceston, when a famous firm was summoned at the instance of the Cornwall County Council on charges which it was stated had never before been made against the company during its eighty years of existence. The defendants, Messrs. Peek, Frean and Co., Ltd., were charged with false warranties in regard to weight in respect of an article of food, "Mrs. Peek's Christmas Pudding", supplied to three well-known local firms, Messrs. Barriball and Sons, Dunn Bros. and Folley and Reynolds. The defendants pleaded not guilty through their solicitor, Mr. R. M. B. Parnall.

Mr. Johnstone, superintendent of the Weights and Measures Department, prosecuting on behalf of the County Council, said there was actually no necessity for Messrs. Peek, Frean and Co. to weigh the puddings at all, but the statement appearing on the tin, "approximately 1 lb.", was so misleading, in view of the weight of the puddings tested, that the County Council felt that they had no alternative but to bring the cases before the magistrates.

Ernest Barriball gave evidence that he purchased a consignment of Christmas puddings from defendants on November 2 last and sold them exactly as he received them.

Henry Fisher, an inspector of weights and measures, said that he visited Messrs. Barriball's premises on December 16 and purchased a Christmas pudding in a tin which bore the statement, "approximately 1 lb.". He weighed the pudding,

and found it to be one ounce fourteen and a half drams less than 1 lb. net. He opened two further tins, and found the contents to weigh two ounces less than 1 lb. net in one case and one ounce eleven drams less than 1 lb. net in the other case. He also visited the premises of Messrs. Folley and Reynolds and there opened three tins the contents of which he found to be two ounces four drams, one ounce fourteen drams and two ounces two drams respectively less than 1 lb. net. At Messrs. Dunn Bros. he also opened two tins, finding the puddings two ounces thirteen and a half drams and one ounce one and a half drams respectively less than 1 lb. net.

The Defence

Defendants called as their first witness the manager of their accounts department, Ralph Pritchard Davis, who said the invoices of the goods in question referred to No. 1 Pudding and not to the puddings as 1 lb. puddings. He explained that the statement on the tin was placed there with the intention of giving the housewife a rough idea as to the weight she might expect to find inside.

The chief chemist and assistant technical manager in charge of Messrs. Peek, Frean's laboratory, Arthur Benjamin Bradley, said that "Mrs. Peek's Christmas Pudding" was introduced last July. He detailed the method of preparation, and pointed out that three checks were made on the weight of the puddings, adding that he had never heard of any such charge being made against the company during its eighty years of existence.

Mr. Parnall, in addressing the magistrates, emphasised that there was no legal definition of the word "approximately", and said the firm put the statement on the tins merely as a guide to purchasers.

The Bench dismissed the prosecution, but the Mayor said his colleagues and himself felt that the County Council was justified in bringing the cases forward, though they also believed that the firm had taken the necessary precautions to prevent deficiency in weight.

Seasonal Variation of Butter Vitamins

A paper of considerable interest was read recently by Dr. H. Wilkinson to the Society of Public Analysts (*Analyst*, January, 1939, p. 17). From the results it seems evident that the vitamin A content of butters undergoes a considerable increase immediately after the beginning of pasture feeding.

The high level reached in June falls away in July, August and September, probably owing to deterioration in the quality of the pasture. In October there is obtained a significantly increased vitamin A potency compared with the two previous months. This is due most probably to the flush of young grass that occurs in the pasture at that period. The cattle were taken from pasture at the end of October, and November samples showed an immediate and rapid fall, which continued through December. This sample possesses about the normal vitamin A potency of winter butter. When the cows went out to grass again there was a sudden rapid increase in the vitamin A potency.

Apparently only during grass feeding is the vitamin A potency significantly increased, and the winter feed is noticeably deficient in carotene. The variations in the vitamin D content were even more profound than those of vitamin A.

Food variation has no effect, and apparently the vitamin D potency varies directly with the amount of solar radiation the cow receives. The peak of vitamin D potency in 1936 corresponded with the maximum number of hours of sunshine per day, and the falling away in the vitamin D potency is closely related to the drop in hours of sunshine per day.

Trade Exhibitions

Described by our contemporary *Food Industries Weekly* as a "bombshell for the food industry", comes the news of the merging of the Grocers' Exhibition with the International Dairy Show at Earls Court.

In an interview with Mr. H. S. Rogers, of Messrs. Trades Markets and Exhibitions, Ltd., promoters of the Grocers' Exhibition, our contemporary gathered that it had been decided that a purely grocery trade exhibition was no longer a necessity. His organisation had therefore handed over the exhibition complete to the B.D.F.A., and he hoped that a change of outlook and surroundings might help to revive interest in grocery exhibits.

Mr. Rogers agreed that the Grocers' Show, as such, could no longer be justified, largely because of the strides taken by branded and proprietary goods during recent years. It was no longer necessary to go to an exhibition since nearly the whole of a grocer's stock can nowadays be taken round in a car and shown to him on his own premises.

We are inclined to echo *Food Industries Weekly's* query whether the purely trade exhibition, held by manufacturers for the benefit of retailers, has had its day?

THE PROCESSING OF ICE-CREAM MIXES

The plant used in the different stages of the manufacture of ice-cream mixes is here discussed by L. J. HYNES

THE FIRST stage in the manufacture of ice-cream on a commercial scale consists in weighing out accurately the quantities of the various materials, in assembling these together to form what is known as the "mix", and in pasteurising the whole at a suitable temperature.

Pasteurisation

This process of pasteurisation is of the utmost importance in the production of wholesome ice-cream and should be carried out with absolute thoroughness.

For the efficient pasteurisation of an ice-cream mix a temperature of 150° to 155° F., maintained for a full half-hour, is advisable. The adoption of a lower temperature, usually 145° F. for the same length of time, was for years quite general, but this was undoubtedly because that temperature was the one invariably used for the pasteurisation of milk. It is now better realised, however, that an ice-cream mix is not milk, and that what is desirable in the case of milk is not necessarily desirable in that of ice-cream. Hence, we find that although some manufacturers still adhere to the old pasteurisation temperature, the tendency is to adopt one of 150° to 155° F., or even a little higher. Indeed, experiments have been made to determine whether the use of temperatures like 170° were not, on the whole, beneficial, but no sufficient reason for adopting such temperatures has yet been shown.

Mixer-Pasteurisers

Mixer-pasteurisers are of various types, the best of them being skilfully designed to provide efficient heating of every part of the mix and, to this end, to keep the mix in a constant state of brisk, but not too vigorous agitation.

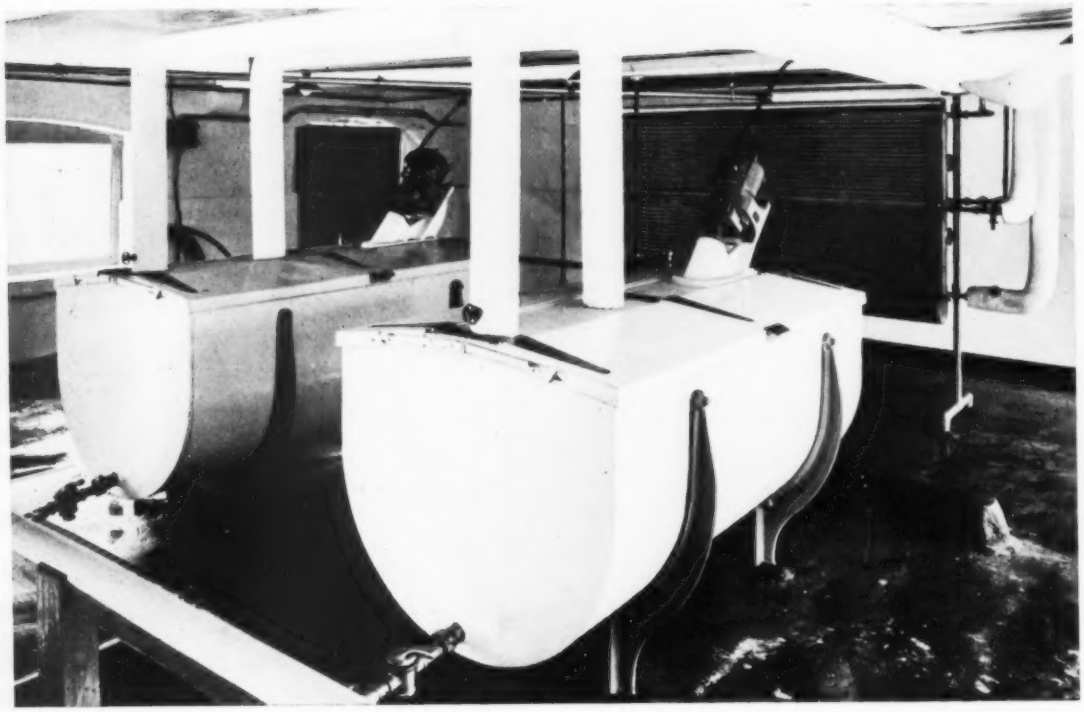
In many cases mixer-pasteurisers of horizontal design are provided with a coil through which, while the coil is rotated, hot water is automatically circulated from, and returned to, a tank. In some cases, however, live steam instead of hot water is used as the heating medium. Paddles are attached to the heating coil, and as the latter rotates, the mix is kept in a constant state of agitation, every particle of it being brought into contact with the coil through which the heating medium is passing. Mixer-pasteurisers of this general type are available in all considerable sizes suitable for the needs of manufacturers engaged in more or less large-scale production.

Machines of vertical types, of which there are several variations, are often used both by large and comparatively small ice-cream makers. Some, including those of smaller calibre, are of the familiar jacketed type and are, of course, provided with a mechanical stirring device. The heating medium may be hot water circulated round the jacket, or steam. Another type, more recent than the simpler designs, is heated by hot water applied in a moving film to the outside of the container. This type, by reason chiefly of the rapid and uniform heating, has much to commend it. The means taken to keep the mix in agitation are various, but in all the reputable makes of machine efficiency may be relied upon. Other things being equal, the simpler the machine the better. Glass-lined mixer-pasteurisers are much in favour, and there can be no doubt that these, besides being efficient, are eminently sanitary.

Homogenisation

The second stage in the processing of ice-cream mix consists in homogenising the entire batch. The layout of the factory should be such that the hot mix, immediately after its pasteurisation, can conveniently be pumped to the homogenising machine and from the latter to the cooler.

The main purpose of homogenisation is the uniform dispersion of the fat in globules of much reduced size and with the original clusters broken up, through the mix. This process of homogenising, or rendering the mix physically uniform, has a marked effect on the whipping ability of the mix, and, as a result of the more facile whipping, on the texture of the ice-cream, which, other things being equal, is invariably better than in the case of unhomogenised products. Homogenisation also makes possible the use of butter, pure butterfat or, as used by some manufacturers, butterfat substitutes, entirely preventing the churning or "buttering" of the fat in the freezer, which would certainly follow if a mix containing



Pasteurisers in a modern ice-cream factory.
("Q" Ice Cream Co., Ltd.)

any such substance in appreciable quantity were not homogenised or otherwise efficiently emulsified.

The homogeniser is a high-pressure pump. The pressure exerted can be regulated to a maximum of about 5,000 lb. per square inch. Under such pressure the mix is forced through a minute aperture, called the homogenising valve, against a block of some specially hard material. This, briefly, is the homogenising principle. Some machines are of single-stage, others of two-stage type. This simply means that in the former the mix is homogenised once, while in the latter it is processed twice, at different pressures.

Temperature and Pressure

Homogenisation should always be carried out at pasteurisation temperature, not at some lower temperature, as would happen, at least in some cases, if there were appreciable delay in homogenising. Homogenising at temperatures much below 150° F. produces mixes of far too high viscosity, and such heavy mixes are notoriously difficult to whip, besides, of course, being relatively awkward to handle.

No hard-and-fast rule can be laid down regarding homogenising pressures. Such factors as the type of machine, the composition of the mix and the materials used largely influence practice in this respect. In general, excessively low pressures produce poor whipping mixes, while too high pressures tend to cause a doughy, pasty body in the frozen product. An average commercial mix will be well suited, in the case of most single-stage machines, by some such pressure as 3,000 lbs., while for two-stage machines pressures of about 2,000 or 2,500 and 1,000 to 1,500 lbs., on first and second stages respectively, will be approximately correct. Proper condition of the machine is, of course, assumed. A defective or badly grooved valve may easily be responsible for totally unsatisfactory results no matter what may be the pressure applied.

Cooling

After being homogenised the mix should be quickly cooled to as low a temperature as possible without, of course, actually reaching freezing point. Temperatures of 40° F. are fairly commonly used, but if somewhat lower can be maintained it is an advantage. The lower the temperature of the mix when it enters the freezer, the better; and further, low temperatures during the ageing period, which follows cooling, prevent the development of acid bacteria and others whose growth at higher temperatures is exceedingly rapid.

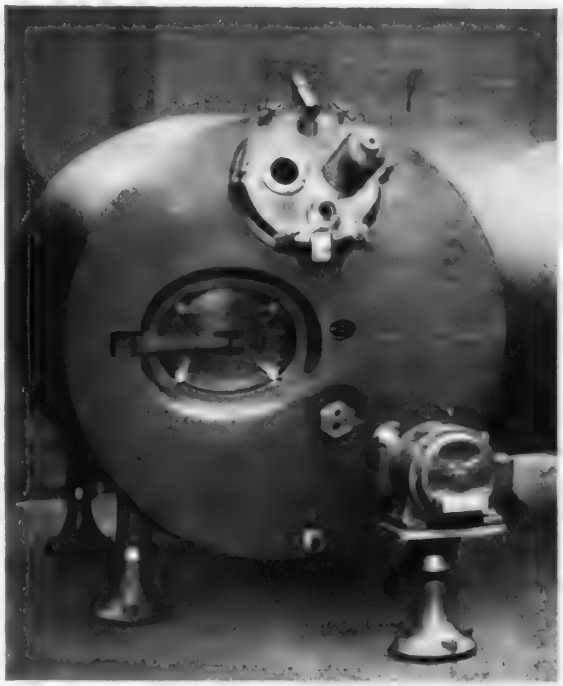
As with most other machines the range of coolers is quite varied. Probably the most frequently used type is the familiar tubular surface cooler similar to that used in dairies. This consists of a set of pipes, cold water being circulated through the upper half and cold brine through the lower, and the mix is caused to flow over these pipes to be collected in a trough under the lowest, and to pass from this trough, by way of a vent-hole, into a vessel placed to receive it. Cooling by this method is very rapid and efficient. In some coolers the lower pipes are chilled

by direct expansion of ammonia or other suitable refrigerant. Direct expansion cooling is generally convenient when the rest of the plant is of direct expansion type, no brine being used for any purpose.

Very large coolers of this general (tubular) type are available for large-scale production; for example, coolers with a mix capacity exceeding 1,000 gallons an hour.

Coil-type coolers, essentially similar—sometimes exactly the same in design—to mixer-pasteurisers, except that a cooling medium is used, are sometimes employed and give good results. When the coil-type pasteuriser is used in a plant it may be convenient to use it also for the cooling of the mix, though naturally this will depend on circumstances. In any case, conversion of the machine from a pasteuriser to a cooler is merely a matter of changing the medium.

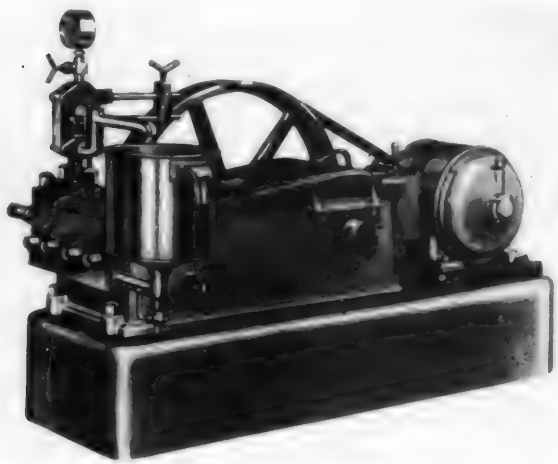
Cabinet coolers have a number of interesting features and possess certain advantages. The internal tube cooler is totally enclosed (the principle is the tube-in-tube idea), and is therefore to that extent hygienic. Here again cooling is accomplished in two sections, the first by water, the second by brine.



Ice-cream mix tanks.
(The Aluminium Plant and Vessel Co., Ltd.)

Ageing

The next step in the processing of ice-cream mix generally consists, at any rate when gelatine is used as the stabiliser, in ageing or holding the mix at or below 40° F.—somewhat below, if possible—for a period of time. As a rule, four hours will be long enough, but if longer ageing can conveniently be managed it is in some cases an advantage. During the ageing period hydration of the gelatine and mix proteins takes place, together with the development of a gel structure in the mix, all tending to prevent the formation of large ice crystals in the ice-cream, and, therefore, to improve its texture. Furthermore, ageing has been found to improve the whipping ability of a mix, this being due, in all probability, to one or more of the foregoing physical changes but possibly affected also by other phenomena. In the case of certain stabilisers other than gelatine, ageing is not necessary. This is the case, for instance, with sodium alginate, and also, at any rate to some extent, with a form of Irish moss.



The "Rannie" homogeniser for motor drive.
(Hiron and Rempler, Ltd.)

The vats used for ageing the mix are, in general, very similar to those used for mixing and pasteurising it, the main difference being that provision is made for keeping the mix cold instead of for heating it. Vats are, therefore, of both the main pasteuriser types, horizontal and vertical, and are generally either glass-lined or of stainless steel. In every case it is important that suitable means of agitating the mix should be provided, of course, in order to facilitate thorough and even cooling. The fact that the mix is agitated in no way affects the development of the properties associated with the ageing period.

The fifth and last stage in the processing of ice-cream mix is the freezing of the product.

Freezers are of two main types: (*a*) batch machines, (*b*) continuous machines. The differences between these types are fundamental. In batch machines a given quantity of mix is frozen as fast as circumstances will permit—in eight or ten minutes, say—after which the ice-cream is drawn off and the freezer made ready for another batch. In continuous freezers the liquid mix can be frozen, in small quantities, almost in an instant, certainly in a few seconds, and freezing proceeds continuously as long as unfrozen mix is fed into the machine. The ice-cream is delivered from a tube or tubes in a steady stream, and, apart from the obvious advantages of rapid and continuous production, possesses two further advantages which are, in fact, outstanding:

Motor-driven, stainless steel, steam-jacketed mixing pan.
(Wm. Brierley, Collier and Hartley, Ltd.)

extreme smoothness of texture and, if desired, an unusual firmness of body. The latter characteristic is due to the freezing of a relatively high percentage of the water content of the mix, a percentage considerably higher than in the case of batch-frozen ice-cream. Naturally, the temperature at the time of withdrawal is also exceptionally low—from about 20° F. or so, some five degrees or more lower than with the batch-frozen product.

Batch freezers, however, may be highly efficient machines and are still used largely. In practically all factories of any size the horizontal type of machine is used. This is either brine-cooled, cold brine being pumped from a tank round the freezer jacket surrounding the cylinder containing the mix, or is refrigerated by direct expansion of ammonia or other refrigerant. Direct expansion machines are generally admitted to be the better, on the whole, but both types give good results. In both cases the refrigerant can be admitted or shut off at will, so that to a considerable extent the freezing operation is under control. This is of the utmost importance for the production of ice-cream with the proper amount of overrun, since whipping of the freezing product to a high point could not proceed unless, after the mix had been brought to a suitable temperature, further freezing could be almost wholly prevented by shutting off the refrigerant. Freezing should not take longer than twelve minutes, and under good conditions often takes less, especially when direct expansion machines are used. The ice-cream, when found by test or observation to contain the desired amount of overrun, should be drawn off at once into chilled cans, either directly or, in the case of very large factories, via a hopper. The temperature of the ice-cream should preferably be in the neighbourhood of 25° or 25·5° F.

Sequence of Operations

With a batch freezer, no matter of which type, it is important that the following order of procedure should be adhered to:

1. Start the machine running.
2. Turn on the refrigerant.
3. Run the mix (by way of the strainer) into the freezer.
4. Add vanilla or other plain flavouring material.
5. Freeze to the correct consistency.
6. Shut off the refrigerant and whip until the desired overrun is obtained; then draw at once.

The continuous freezer, when equipped by the appropriate control device, can deliver ice-cream either soft or firm, as may be desired. The overrun is not dependent upon whipping; a proportion of air, in quantity as desired, is pumped into the product. This air should be filtered. The latest machines of continuous type are unquestionably highly efficient and are coming more and more into use. Not the least of many advantages is that they admit of packets being filled direct from the freezer instead of, as in the case of batch-frozen ice-cream, by a packaging machine after the ice-cream has been withdrawn.

Boiling Water for the Laboratory

The gas industry has already produced instantaneous water-heaters to give *hot* water in laboratories, factories, canteens, etc., as well as in the house. Now it has invented a similar heater which gives *boiling* water practically instantaneously, in addition to a hot and warm supply.

This heater has a three-temperature control. A turn of the control gives warm, hot or boiling water at will. Turned to "warm", the heater gives 1¼ gallons of water at 90° F. in a minute; turned to "hot", it produces half a gallon of water at 150° F. in a minute; turned to "boiling", it gives a supply of boiling water in 40 seconds and allows 2½ to 3 pints to be drawn in a minute. The supply of hot or boiling water is unlimited and the user can draw as much as is wanted. The heater is automatically controlled and is very economical in use.

KIPPERS IN COLD STORAGE

The storage of food is becoming an ever-increasing factor in modern conditions of food supply. Dr. A. Banks, Ph.D. (Liverpool), A.I.C., here describes the important research work carried out on Britain's favourite breakfast dish, at the Torry Research Station, Aberdeen.

EACH YEAR considerable quantities of kippers are exported from this country and the voyage may last for periods up to six weeks. Owing to seasonal variations in the supply of herrings, combined with a steady demand for the exported kippers, stocks of the latter are kept in this country for various times, in some cases for four months. Storage at low temperatures has therefore been necessary, and it is usual to find that the kippers are stored at 7° to 14° F. before being exported, and at 10° to 18° F. during the transport overseas. Kippers undergo considerable change in quality during storage at these relatively high temperatures, and an investigation of the effect of various conditions of storage on the quality of frozen kippers has been carried out at the Torry Research Station.

Preliminary Experiments

The first of a series of experiments consisted of an examination of the effect of storage at 14°, −4°, and −18·5° F. on the loss of weight and change in general appearance and flavour of frozen kippers, the development of rancidity being observed by chemical as well as by organoleptic methods. Kippers wrapped in vegetable parchment paper and packed in one-stone boxes were air frozen, and stored at the three temperatures for six months. Examinations were made each month, and the results are shown in Figs. 1 and 2.

It is well known that smoke-cured fish lose an appreciable amount of weight through evaporation during storage at 14° F., and in practice it is usual to allow for any loss that may occur in this way. The magnitude of the loss that takes place during storage at lower temperatures is not, however, so widely known. Fig. 1, in which the actual losses of weight per stone of kippers during storage at 14°, −4°, and −18·5 F., are given, clearly shows that there is a greater loss of weight the higher the temperature of storage. After one month's storage at 14° F., this loss amounted to nearly 4 ozs., after three months to nearly 10 ozs., and after six months to a little over 21 ozs.; and it is clear that if kippers are to be stored in lots of 14 lbs. at this temperature for three or four months, an extra 10 to 16 ozs. must be added as overweight prior to storage. At −18·5 F. only a slight loss of weight could be observed, amounting to 1 oz. after three months' and 4½ ozs. after six months' storage. The loss of weight at the intermediate temperature was slightly more, being 4 and 7 ozs. after three and six months' storage respectively.

Lower Temperatures Better

The progressive changes in quality, including appearance, flavour, etc., during the storage of kippers at the three different temperatures are given in Fig. 2, and again it is evident that the least change takes place at the lowest temperature. The excessive drying that takes place at 14° F. had an effect on the appearance of the kippers. "Freezer-burn" and a bleached appearance, particularly of the gut cavities, were evident after two months, increasing in intensity with further storage, and the kippers soon became dry and shrivelled. The loss of smoky aroma, together with the development of a "stale smoky" or "boxy" odour, could also be detected as storage proceeded. There was a change, too, in flavour. After one month's storage the kippers were not as sweet as fresh, and after two months rancidity was easily detected in the brown flesh. This increased in intensity and spread to the white flesh, the kippers soon becoming unpalatable. There was also a progressive loss of general kipper flavour, coupled with the development of a "sweet malty", "boxy" or "stale smoky" flavour. It was clear therefore that, except for very short periods, kippers could not successfully be stored at 14° F.

Storage at the two lower temperatures resulted in definitely superior products. A slight progressive bleaching, particularly of the gut-cavities, was noticeable, more so in the kippers stored at −4° F., and they were generally paler and slightly drier in appearance than those stored at −18·5° F. There was, however, a big difference in flavour. After three months' storage at −4° F., the kippers were not as sweet as fresh kippers; a slight suggestion of rancidity, together with a "cold-storage" flavour and a loss of smoky flavour and aroma could be detected. These changes in flavour became more marked during the next three months. Changes of this nature

also occurred in the kippers stored at −18·5° F., but not nearly to the same extent; in fact, after four or five months' storage at this temperature the kippers were little inferior to fresh kippers.

Storage Prior to Export

The second of the series of experiments consisted of an investigation of the possibility of improving the quality of exported kippers by the use of lower temperatures of storage prior to export. For this purpose, kippers, packed in half-stone boxes, were frozen and stored at 14°, −4°, and −22° F. After three months, boxes of kippers were transferred from the lowest to the two higher temperatures, and from −4° to 14° F. Boxes of kippers were kept at the three temperatures as controls, and the kippers were examined for general quality after 0, 2, 4, and 6 weeks under the new conditions. The results are shown in Fig. 3.

Consideration of the quality of the kippers stored at 14°, −4°, and −22° F. all the time, shows that the results agree with those of the previous series, in that storage at 14° F. causes a rapid deterioration, at −4° F. the kippers are quite good for the first three months, and at −22° F. the kippers are definitely superior, particularly in flavour, for longer periods. Transferring the kippers from storage at −22° to −4° F. does not appear materially to affect the general quality over a period of six weeks. Little change in appearance took place, but a change from a fresh to a slightly rancid and "cold-storage" flavour could be readily detected. Raising the temperature of storage from −22° to 14° F. caused a more definite change in the quality of the kippers. After two weeks they were just slightly better than the control kippers at −4° F. After four weeks they were somewhat inferior, and at this stage the effect of storage at the higher temperature became evident. Much bleaching had taken place, the layer of fat beneath the skin had a yellowish-green colour and rancidity and other "off" flavours were definitely present. After six weeks these various changes in appearance and flavour had become more marked. The effect of raising the temperature of storage from −4° to 14° F. was similar, save that changes due to storage at the higher temperature were apparent after two weeks and increased in intensity with further storage. However, in this case, as in the former, the kippers were in much better condition than the kippers that had been at 14° F. all the time.

It is evident, then, that when kippers are stored at −4° and −22° F. for three months and then transferred to 14° F., they are in a better condition after six weeks than kippers that have been at this temperature for four and a half months, but the deterioration caused by storage at this temperature is so great that it would appear that some lowering of the temperature during transport overseas would also be necessary if the general condition of exported kippers is to be greatly improved.

Kippers or Herrings?

On the basis of these results, the question arose whether it was better to store kippers as such or to store herring and to kipper them after storage. A comparison of the changes in the quality of frozen herring and kippers during storage at low temperatures has accordingly been made.

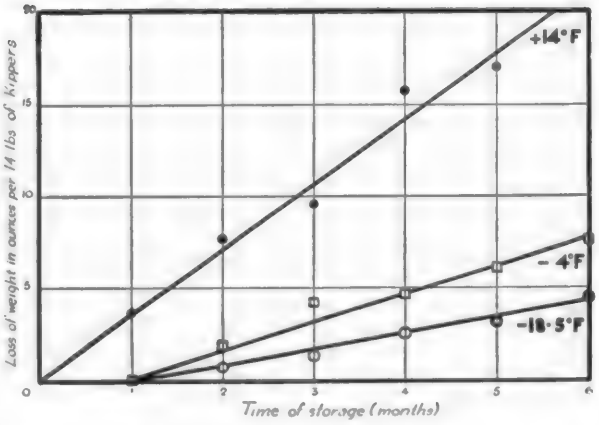


FIG. 1.—Loss of weight of kippers during storage.

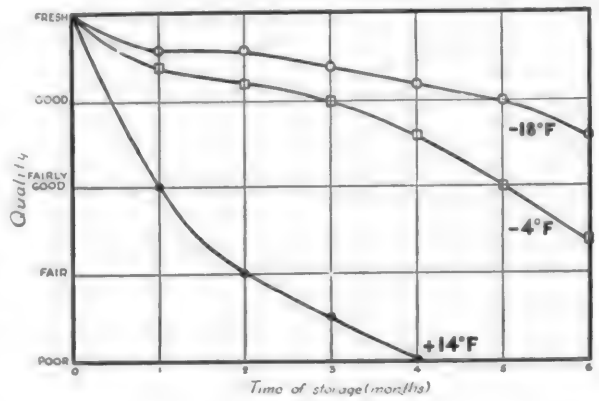


FIG. 2.—Change in quality of kippers during storage.

For this purpose, a sample of an average catch of herring was divided into two lots. One was kippered, packed in the usual way in half-stone boxes, and stored at −4° and −22° F. The other was frozen in circulating brine at −4° F., well washed, glazed, and stored at −4° and −22° F. After three months' storage, the herrings were rapidly thawed and kippered. The frozen kippers were thawed and the two lots of kippers were compared with respect to flavour and appearance and by chemical tests for rancidity. This procedure was repeated after six months' storage, and the results are shown in Fig. 4.

After three months' storage at −22° F. the frozen herring made excellent kippers; in fact, they were practically equal to fresh in all respects. The kippers stored at this temperature were not quite so good. They were slightly bleached and the gut-cavities were not quite fresh in appearance; they were not as sweet and had not quite the same fresh smoky flavour and aroma as the kippers made from the frozen herring.

The kippers made from the frozen herring stored at −4° F. were not as good as those made from the herring stored at the lower temperature, but they were quite good in appearance and had a good smoky flavour and aroma, though slight rancidity could be detected. On the whole, they were about equal in quality to the kippers stored at −22° F. The kippers stored at −4° F. were similar to those stored at −22° F., except that the changes due to storage were more pronounced and they were somewhat inferior to the corresponding kippers made from the frozen herrings.

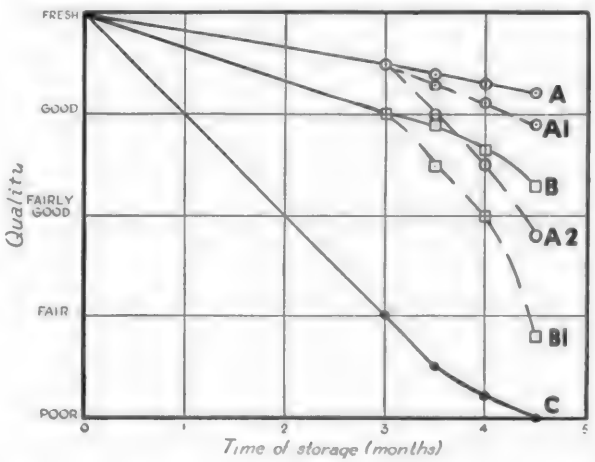


Fig. 3.—The effect of raising the temperature of storage on the quality of kippers.

A, Control at −22° F.; A.1, raised from −22° to −4° F.; A.2, raised from −22° to +14° F.
B, Control at −4° F.; B.1, raised from −4° to 14° F.
C, Control at +14° F.

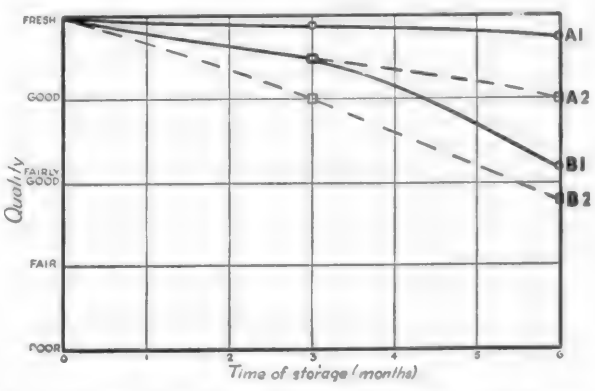


Fig. 4.—The quality of cold stored kippers and kippers made from cold stored herrings.

A.1, Kippers made from frozen herrings stored at −22° F.
A.2, Frozen kippers stored at −22° F.
B.1, Kippers made from frozen herrings stored at −4° F.
B.2, Frozen kippers stored at −4° F.

Six Months' Storage

After six months' storage, little further change had taken place in the quality of the kippers made from the frozen herring stored at −22° F. They were still excellent in general appearance and flavour, and differed only a little from kippers made from fresh herrings. The kippers stored at this temperature were again not so good; slight rancidity could be detected in the brown flesh, and on the whole the fish seemed somewhat dry and bleached, while the gut-cavities were slightly staler than at three months. There was also a certain loss of smoky flavour and aroma. The kippers made from the frozen herring stored at −4° F., although bright, were dry in appearance and taste. They had a good smoky aroma and flavour, but there was definite evidence of the presence of rancidity and "cold-storage" flavours were readily detected. The kippers stored at −4° F. were similar to those stored at −22° F., except that the defects were more pronounced. Rancidity and "cold-storage" flavours were rather strong, and on the whole they were definitely inferior in quality to the kippers made from the stored herrings. In all cases it was noted that whereas the kippers prepared from the stored herrings were quite firm to the touch, the stored kippers were inclined to be somewhat soft or limp.

It would seem, therefore, that although kippers can be stored at −22° F. to give a good article after four or five months' storage, herring yield a better product when stored at this temperature and subsequently kippered. Rancidity develops more rapidly in the kipper than in herring during storage, despite the presence of smoke constituents in the former. The development of rancidity in herrings during storage is due to an enzymic system that has the property of being activated by common salt; it would seem that the enzymes are not destroyed during the process of kippering, and that the presence of a relatively large proportion of salt in the flesh of kippers overrides any beneficial effects contributed by the condensation of smoke products on the surface of the fish.

Advantages of Storing Kippers

The storage of kippers, however, has some important advantages. Herring lose about 30 per cent. of their weight when eviscerated and kippered, and since kippers can be packed more closely than frozen herring, it is obvious that some economy in the cost of freezing and in storage room can be effected by freezing kippers instead of herrings. This objection to the freezing of herrings could be overcome to some extent by freezing gutted herrings (*e.g.*, herrings split as for kippers) in some form of package. This procedure is at present under investigation.

LITERATURE

Banks, A., and Reay, G. A., Annual Reports of the Food Investigation Board, Department of Scientific and Industrial Research for the years 1936 and 1937.

Banks, A., *J. Soc. Chem. Ind.*, **56**, p. 13T (1937); *J. Soc. Chem. Ind.*, **57**, p. 124T (1938).

CHEMICAL AND BACTERIOLOGICAL

ERIC HUMPHRISS, A.I.C., F.R.M.S.

THE MATTER of statutory standards for ice-cream has been more or less to the fore since 1928, in which year the Ice-Cream Association of Great Britain and Ireland approached the then Minister of Health with a request that ice-cream might be legally defined. This rather unusual move on the part of a trade association attracted the attention of other interested parties, with the result that such influential bodies as the Society of Medical Officers of Health, the Royal Sanitary Institute, and others have lent their support.

The subject has, in the past ten years, frequently been commented on by medical, scientific, and sanitary authorities; and with the passage into law of the Foods and Drugs Act, 1938, it would appear as though we are, in the next year or so, to witness the making of food regulations controlling the quality and composition of ice-cream.

Northern Ireland Regulations

Northern Ireland already has a "Sale of Ice-Cream (Northern Ireland) Act, 1937", wherein ordinary ice-cream, and a special grade, "Premium" ice-cream, are defined. Briefly, ice-cream is required to test not less than 5 per cent. milk fat, and 30 per cent. total solids; to weigh not less than 5½ lbs. per gallon and to contain not more than 200,000 bacteria per c.c.; nor any coliform bacilli in 1 c.c. The "Premium" grade of ice-cream is of 6 per cent. minimum fat content; must not be made from skimmed milk, and the mix must contain 5 pints per gallon of graded milk. This legislation has been operative in Northern Ireland since June, 1938.

Legal standards to which ice-cream is required to conform exist in several European countries, Holland, one of the first and most stringent, banning the use of starch in ice-cream. Several of the Dominions—Canada, Australia, for example—already have legal standards to which all ice-cream manufactured therein has to conform.

In U.S.A. each State has its own standard, and there is, in addition, a Federal Standard of 14 per cent. in the case of milk fat content. The operative standards are those of the individual States, and they vary from 8 to 14 per cent. in milk fat minima, most of them prescribing 8 or 10 per cent. Some have enactments relating to total milk solids (of the order of 18 per cent.), whilst other States prescribe separate standards for milk fat and milk-solids not-fat. Quite a few specify a fraction of one per cent. of gelatin as stabilizer, and several have bacteriological standards expressed in terms of total bacteria count. Practically all States require that the mix shall be adequately pasteurised, and many control, in some measure, overrun, by prescribing a minimum weight per gallon for the frozen ice-cream, or alternatively, a minimum weight of food solids per gallon of finished ice-cream.

British Conditions

The conditions appertaining to the ice-cream industry in Great Britain are, in some respects, peculiar. Here, a considerable proportion of the commodity sold as ice-cream consists essentially of a low fat mix (3 per cent. or so milk fat) containing some 6 or 7 per cent. milk-solids-not-fat, sweetened with about 12 per cent. of sucrose and stabilised with 3 to 4 per cent of corn starch. This mix is, of course, prepared by the "boiling or cooking technique", and is of inferior palatability and food value, and possessed of only transient textural quality. Then there is the genuine dairy product ice-cream of 10 to 14 per cent. (or even more) milk fat content, testing 10 to 11 per cent. M.S.N.F., 13 per cent. or so sucrose and approximately ½ per cent. gelatin or possibly a similar amount of sodium alginate or a proprietary stabiliser. Again, there is the comparatively recent development of replacing a portion of the milk fat by a "vegetable" fat, usually a mixture of deodorised solid and hydrogenated liquid oils, usually of vegetable origin, and marketed under various trade names.

Chemical Standards

It is difficult to see how any useful chemical standard could be devised which would embrace all three types of frozen confections described above, even if such a course were deemed desirable. The Ice-Cream Association standard includes a minimum milk fat content of 8 per cent.; an equitable figure sponsored by numerous precedents abroad. Milk-solids-not-fat are fixed at 10 to 10½ per cent. as a maximum by technical considerations related to lactose solubilities and the serious defect known as "sandiness", and since the benefits derived from this maximum content quite outweigh the cost of adding the necessary serum solids concentrate, it does seem open to doubt whether or not the fixing of a standard for milk-solids-not-fat would be worth while. On the other hand, the nutritional value of ice-cream is in no small measure a function of its calcium, phosphorus, and milk protein content; all constituents of the milk-solids-not-fat fraction of the mix.

At first sight it appears unnecessary to allow the use of 3 per cent. or so of cornflour to accomplish a job of

STANDARDS FOR ICE-CREAM

mix stabilisation which is equally well performed by ½ per cent. of gelatin. But it must not be forgotten that the additional 2½ per cent. of solids gained by the use of starch is of material benefit to the organoleptic quality of the frozen product where the fat content is of the order of 8 per cent. There is obviously no point or necessity to legislate for mix sugar content, it quite definitely and within fairly narrow limits fixes itself.

Restricting Dairy Products

There is absolutely no technical, scientific, or nutritional basis for restricting the selection of dairy product ingredients to form the mix combination. Such a course would undoubtedly be strenuously resisted by the trade and could only be put forward from motives of political (or other) expediency.

No really serious objections can be raised to some form of aeration, swell, or overrun control; the food solids per gallon is the theoretically more equitable method since it permits of a somewhat higher overrun being taken on a richer ice-cream. Sale of ice-cream by weight is a quite impracticable procedure, and, in passing, this point was successfully urged by a deputation from the Ice-Cream Association which waited upon the Minister of Agriculture of Northern Ireland and to which the writer was privileged to act as technical and scientific adviser.

Now as to the desirability of some bacteriological control of ice-cream manufacture there can be no question. The form such surveillance may best take in order to achieve its object is less a matter of unanimity.

Bacteriological Purity

The most important thing is to ensure that ice-cream shall be free from pathogenic organisms, and probably the one ordinance of itself most likely to nearly achieve this end is compulsory pasteurisation of the mix, or of the dairy product ingredients of the mix. But such a requirement could give no guarantee against post-pasteurisation contamination and moreover would bear heavily upon the smaller units in the industry.

It may well be that the setting up of a bacteriological standard in terms of a maximum permissible total colony count, and a presumptive coli test, would, used as an educational instrument, do more to ensure the bacteriological purity of the commodity than would compulsory pasteurisation of the mix or its dairy product ingredients. Furthermore, it seems a little unfair that such requirements should be demanded of the ice-cream maker when no such parallel demands are made on dairymen as to their milk and cream supplies. It is not difficult for anyone with a first-hand knowledge of dairy bacteriology to conceive of circumstances where a small ice-cream manufacturer would be entirely in the hands of his milk and cream, etc., supplier, who would be under no sort of obligation as to his supplies, whereas the ice-cream man would be liable to be penalised in respect of his product made therefrom.

Total Bacteria Content

As to the numerical magnitude of the total bacteria content permitted in ice-cream the writer puts forward the following suggestion, which he has, incidentally, urged on interested parties previously. It is suggested that a progressively severer standard extended over three years be introduced.

First Year:	*Not more than*	500,000	*bacteria per ml. of mix*						
Second Year:	,,	,,	,,	250,000	,,	,,	,,	,,	,,
Third Year:	,,	,,	,,	100,000	,,	,,	,,	,,	,,

The standard for the third year would be a permanent one.

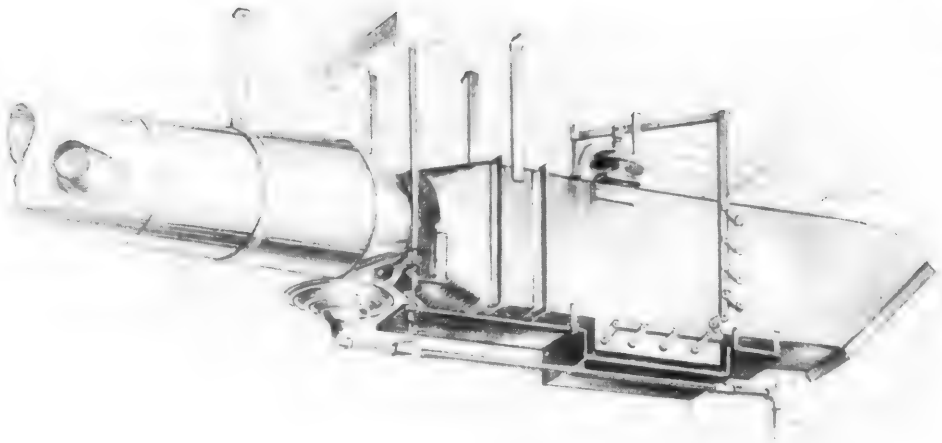
There is a precedent for this gradually decreasing standard in the legislation appertaining to this side of milk control, and the final figure is that at present in force for pasteurised milk and is more stringent than the American ice-cream legislation.

Limits might well be prescribed for the *coli-aerogenes* group of bacteria, for they are, amongst other things, a useful index of plant contamination in an adequately pasteurised mix. In fixing these limits, due regard should be paid to the fact that the dairy product ingredients are the chief initial source of bacteria in ice-cream, and therefore the actual numerical limits should bear the same relation to those already fixed for milk as does the Total Milk Solids of ice-cream to the Total Solids of milk. This, very roughly, is (Total permissible count for milk) × 2 = Total permissible count for ice-cream. This would, at any rate, give a rational "maximum inevitable bacteria content" for ice-cream, and in the last analysis this is really all a bacteriological standard purports to be.

Analytical Technique

In concluding this brief review of the main points relevant to the matter of the setting up of standards for ice-cream, one last point may be mentioned. It is as to the desirability of publishing analytical methods, by which the necessary determinations are to be made, simultaneously with the setting up of the standards.

Standardisation of technique is especially necessary in bacteriological work in order that results obtained in different laboratories may be correlated, and injustice, due to differences in methods and technique, avoided.



Zone-conditioning system employing a Mellor-Bromley individual unit and combining heating with ventilation.

AIR CONDITIONING AND THE FOOD INDUSTRY

The importance of temperature, humidity and air composition is being increasingly recognised in the food industry, and air conditioning controls these factors. In this article an expert discusses some of the implications of this comparatively new auxiliary available to the food manufacturer.

IT IS no exaggeration to say that many industries would stop production if some form of temperature and humidity control were not available. The food industry is no exception to this rule, an ample number of examples being afforded in such operations as baking, in which is included cake icing, mixing, dough fermentation, loaf cooling, proofing cabinets and flour and yeast storage, etc.

In confectionery manufacture air conditioning is necessary in connection with chewing-gum rolling and wrapping, chocolate covering and storage, among other things. Milk cooling, butter making, the preparation of cereal foods, the ripening and storage of fruit and the storage of meat are other examples of air-controlled operations.

In this short review of air conditioning, the subject will be treated from the point of view of the factory as a whole, or at least those parts of it wherein numbers of workpeople are congregated in packing, sorting and generally overseeing the various processes.

Temperature and Humidity

Air conditioning implies the maintaining of definite temperatures and humidities suitable for the particular processes which are involved. It is essential that these conditions be kept constant and within close definite limits regardless of the season or other offsetting factors which may be in existence in the factory itself or due to its peculiar site exposure.

These conditions are maintained by a supply of air suitably treated—*i.e.*, thoroughly filtered and washed—whereby it is cleansed of dust, dirt, bacteria, pollen and soluble gases, and is delivered in such a manner as to permit a circulation of invigorating air throughout the rooms.

The primary reasons for the installation of air-conditioning plant is undoubtedly the production of goods in perfect condition. The health and efficiency of the workpeople, however, is not to be neglected, and can often have a very great bearing on the economies which can be effected in producing a better article. Hence, when installing plant to provide for a better product and increased production, the welfare of the workpeople is automatically ensured.

In consequence of a supply of thoroughly cleansed air of tempered condition, there is less absence due to sick leave, and a brighter and more ready reaction to responsibilities on the part of operatives. This is more noticeable when work has to be done in a heavy or vitiated atmosphere, more often than not slightly overheated, and

is even more apparent in the afternoons and early evenings when the operatives' energies naturally flag. In supplying the air to maintain healthy conditions, the room is kept under rigid temperature control, neither too cool nor too hot, and a sufficient vapour pressure is maintained to enable the air to find an exit from the room through doors, windows and various other crevices, this expulsion of air definitely preventing the infiltration of foreign, dusty and, possibly, polluted air from outside.

These conditions may be compared with those sometimes found even in these days, but which are gradually being eliminated. They consist of extremely haphazard heating at the mercy of an operative who, with other work to do, has to remember to control various hand shut-off valves and the stoking of the boiler. Work is first started in a cold room. Then, as the temperature is built up, the atmosphere becomes unpleasantly hot before the necessity for tempering the heat is realised.

Air-conditioning plant installed in a food factory.
(Air Control Installations, Ltd.)

Effects of Dryness

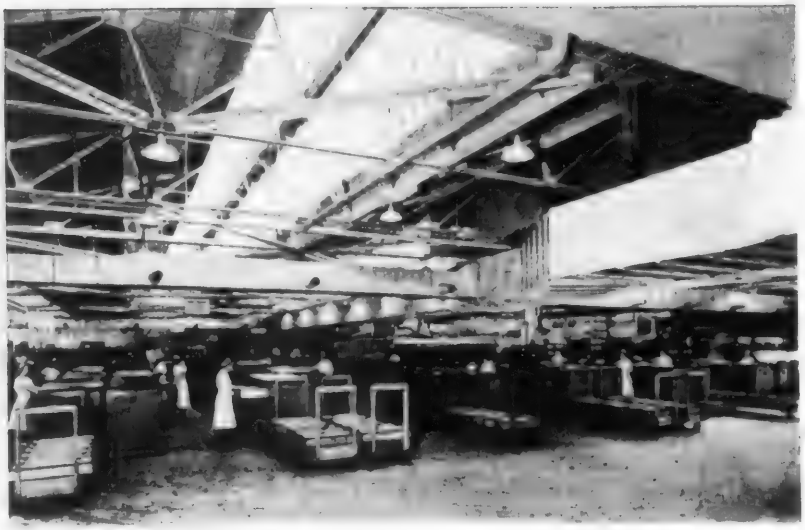
Lack of humidity control is definitely dangerous, particularly when the inside temperature reaches high limits in winter and a dry and dusty condition is produced at the back of the throat and nose of the worker. Lack of air movement is also a very serious factor, involving as it does a heavy and tiring effect upon the worker. Attempts to remedy this lack of air movement by the placing of exhaust fans is in many cases to be deprecated, due to the fact that air is drawn into the building to replace the expelled air, and this air is likely to be extremely dusty and even polluted. Whatever food is manufactured, it is important that air, with its intimate contact with the product, should be of the highest quality. The rate of evaporation and of bio-chemical reaction is controlled by the quality of the air. An example of this is the dough-room of the modern bakery. Yeast develops best at a temperature of 80° F., with a relative humidity of 65 per cent. The surface of the dough must be kept open to allow the carbon dioxide formed by fermentation to pass through, producing a loaf, when baked, of even, fine texture, without large voids, and with a good appearance and taste.

Another example of a similar process is found in the cooling of macaroni. The flour and water mixture is fermented and dried, and, as it is necessary to have a definite amount of water present to carry on the fermentation process, the moisture must be removed in a relatively short period to stop fermentation and prevent souring.

Curing of Fruits

The curing of fruits, such as bananas and lemons, is still another example. In the case of bananas, to accomplish the desired results a cycle of temperatures and relative humidities is followed. Starches in the fruit must be changed and the skin cured and coloured, after which as slow a rate of metabolism as possible is maintained. The difference in the treatment of lemons and bananas consists in the fact that bananas are cured for a quick market, whereas lemons are held for a future market. Relative

Conditioned air in a packing and wrapping room in a biscuit works.



"York" air-conditioning plant installation serving all departments of a modern bakery.
(York Shipley, Ltd.)

humidities are of definite value in treating lemons in order to keep shrinking to a minimum and at the same time to develop the rind so that it will be sufficiently tough to permit handling.

Rate of Cooling

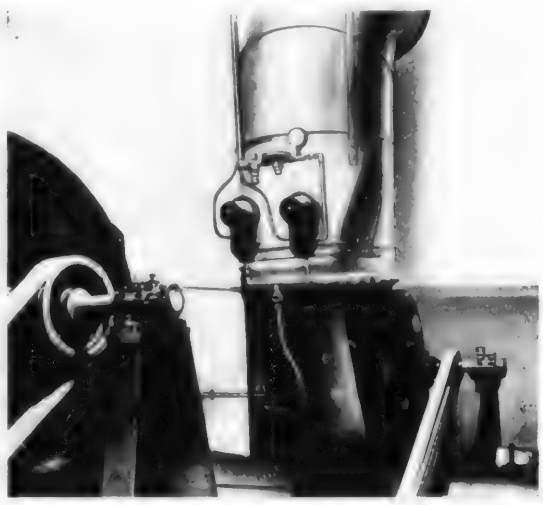
The rate of cooling also is of interest, inasmuch as it determines the size of crystals formed where sugar is involved. Both temperature and relative humidity are of importance, as one controls the rate of cooling while the other, through evaporation, changes the density of the solution. In pans for pills, gum and nuts where a sugar solution is added to the tumbling mass, each separate piece is covered with crystals of sugar as the water evaporates and a smooth opaque coating is only accomplished by supplying the kettle with the correct amounts of air at the right temperature and relative humidity. If the cooling and drying is too slow, the coating will be rough and translucent; if too fast, the coating will chip through to the interior. It is only by proper control of temperature, humidity and air volume that a perfect coating can be assured.

Various processes and applications require a variety of treatment and, for some, high relative humidities up to 85 or 90 per cent. are a definite necessity, whereas others such as packaging of biscuits—particularly those of the chocolate-covered variety—require relative humidities within the region of 40 or 50 per cent.

Types of Plant

The types of plant which are available and are necessary for plain air conditioning, involving care of the process under consideration, vary considerably both with the application and the manufacturer's particular requirements. It is not the purpose of this article to discuss the types of plant which can be put forward. Suffice to say that modern plant is featured by the low first cost, small running costs and the provision which is made for quietness of operation, both in the mechanical moving parts and in the movement of the air. In the majority of cases, they are also entirely unobtrusive in appearance and in no way constitute an eyesore in the factory. The evolution of temperature and humidity controls has resulted in their almost foolproof operation, necessitating only a periodic attention to the plant for overhaul and for general oiling and greasing, effecting a distinct saving in manual operation and fuel consumption.

Some two or three years ago, one often heard of the desire of manufacturers to incorporate such a plant, but some were deterred by the amount of capital to be expended. Those manufacturers, however, who have incorporated full air conditioning in their factories have been the first to admit that the money spent has been more than repaid by results. Proof of this is found in the increased number of additions to existing air-conditioning plants and the extensions which are being carried out, quite apart from the installation of entirely new plant.



Double inlet for a dual-purpose conditioning plant which is divided into two sections.
(Mellor Bromley and Co., Ltd.)

The attractiveness of quick-frozen fruit and vegetables is shown by this photograph of products frozen in paper cartons and tin cans. These were tested in a USDA laboratory in Washington, D.C.

British Refrigeration Experts Discuss

METHODS OF QUICK FREEZING

NOVEL DEVELOPMENTS in quick freezing were presaged at the recent meeting of the British Association of Refrigeration. An ultra-rapid process, which has been much discussed in America and upon which considerable research has been expended, consists, among other things, in applying very low temperatures over very short periods of time.

In a paper read by Mr. Walter S. Josephson he described experiments, not only embodying this idea, but also using carbon dioxide as one of the determining factors in the preservation of foods. Hitherto the obstacle has been high costs, but the speaker believes that he has solved this part of the problem as well.

During tests connected with the production of "dry ice", research was carried out in food preservation, and it was during these experiments that carbon dioxide, in combination with low-temperature freezing, was utilised.

Instant Freezing

The principle on which this process is based is briefly as follows.

We have found that if the products to be preserved are exposed to direct contact with an atmosphere of liquid and gaseous carbon dioxide under high pressures and at low temperatures, the following results are produced:

(1) The occluded gases containing oxygen in the pores of the material are replaced with carbon dioxide.

(2) That any moisture in the pores or on the surface of the material to be frozen is converted into dilute carbonic acid.

(3) That most of the bacteria, and all the spore-bearing bacteria that have been tested, located on the surface of the product coming in contact with the carbon dioxide are killed, and the spores rendered non-viable.

(4) Due to the rapidity with which the heat is extracted from the material being frozen—that is, due to the fact that the materials are passed through the crystal-forming temperature zone with such great rapidity—the materials are frozen with a total absence of crystal formation, and, due to this instantaneous freezing, there is no destruction of cell tissues and the cells are quite intact. The protoplasm inside the living cells is a semi-gel and semi-sol structure whose dispersed phase is of protein particles and whose continuous phase is a crystalloid solution. Under ordinary freezing and/or quick-freezing methods there is a tendency for the water of the continuous phase to separate out in large or small ice crystals in an irreversible manner, producing destruction of the cells and changes in protoplasmic characteristics.

Under the subject instantaneous freezing process, the protoplasm is solidified but still retains its gel structure, and after freezing and during the entire period of storage its vitrified condition is maintained. An analogy to this condition may be found in the structure of glass, which, although physically a solid, maintains the structure of a liquid.

It is interesting to note that, as a result of the unimpaired cell structure maintained in frosted products through this process, upon defrosting, a test on some of the products treated disclosed that the cells were still alive.

(5) At the conclusion of the freezing process the materials frozen have been reduced to approximately −100° F., which appears to fix the condition of the materials, which thereafter remain unchanged during the period of storage at temperatures of 0° F.

The freezing time required for 1 lb. packet of peas starting at 45° F. to 100° F. at conclusion of the freezing process is less than one minute. This will give you some indication of the rapidity of freezing and is the obvious explanation for the remarkable results achieved, as the freezing time through the critical temperatures does not permit of any cytological changes.

The flavour and odour of foods preserved by this process have been generally pronounced to be indistinguishable from absolutely fresh food products, and it is our contention that, inasmuch as the condition of the materials processed remains unchanged, they are, in fact, fresh foods.

The vitamin content of foods processed is retained, as nearly as can be ascertained, in its entirety.

Great interest was evinced by the numerous experts present, and, after other papers had been read, Mr. Josephson was subjected to many searching questions.

Asked for further details of his process in connection with peas, he said that these were packed in their containers and put into a metal receptacle with an open top. The pressure during the freezing was 100 lb. per square inch, and 250 packets of peas could be frozen in 1 minute.

Further questions, and Mr. Josephson's replies, were as follows:

Q. What happens when the peas are taken out of the freezing unit?

A. The peas are wet before freezing, and when taken out their pores are filled with CO_2 and they are covered with a film of carbonated water.

Q. Does not rupture take place due to the emission of gas when the peas are brought from 100 lb. per square inch to atmospheric pressure?

A. No. There is such a small quantity of gas dissolved. Moreover, dry ice does not explode when taken from the freezing presses, although it has been under a pressure of 2,500 lb. per square inch.

Q. Can all quick-frozen produce be stored at 0° F.?

A. Some produce should be kept at lower temperature. For instance, fish high in oil content will give better storage results at −10° F., but at 0° F. it is good after six to eight months.

Q. Is storage carried out in air or CO_2?

A. Air. The cell, after instant freezing, is intact, and, as the goods are protected by a coating of carbonated ice, this is equivalent to CO_2 storage.

Q. What are the costs of the process in comparison with other quick-freezing processes?

A. No difference.

Q. Do peas require blanching before freezing?

A. Although the action of enzymes is inhibited without it, a short blanching is carried out in order to preserve the colour.

Q. Why are the bacteria killed during the process, while the cells of the produce remain intact?

A. Vegetable cells are permeable to CO_2, whereas bacteria are not.

Q. It has been said that *all* spores are killed and *most* bacteria. How is this?

A. The work of Dr. McLean, who performed the bacteriological work, was referred to.

Q. What is the effect of instant freezing on oil structure? Is there separation of the olein and stearin?

A. No separation takes place.

Q. Cost of storage?

A. With coal at 24s. 6d. per ton, it costs 1d. per lb. of produce per year in a store 100,000 cubic feet at −10° to 0° F.

Mr. W. H. Peak's Paper

The commercial development of quick freezing in Great Britain and the Empire was discussed by Mr. Peak, Member of Council of the Association. He was chiefly concerned with the problems of distribution of quick-frozen produce through retail outlets. The progress of the industry must depend upon the solution of these problems.

An important factor is the education of the public. A central organisation, representing all the interests in the new industry, should be created to undertake, among other things, the task of public enlightenment. Such an organisation would eliminate competition between producers and relieve them of all marketing and distributing expenses, and would be in a position to undertake the development of the industry on a planned basis in co-operation with interests best suited to the producing side.

Bird's Eye Process

Mr. W. T. Murray, technical expert of the Frosted Foods Sales Corporation of New York, read a paper on the application of low-temperature conduction freezing for perishable foods.

Mr. Murray gave some interesting figures showing the elimination of waste. In the U.S.A. this factor, as well as that of convenience, had been amply recognised by the public.

The following table indicates the actual elimination of waste in vegetables, fruits, sea foods, meats and poultry. No figures are shown for fruits such as raspberries, strawberries, sliced peaches, etc., as these fruits are carefully selected and packed at the time when they are perfectly ripened and there is no waste or spoilage to be added to the cost.

ELIMINATION OF WASTE

Product.	*Per Cent. Waste Eliminated.*	*Product.*	*Per Cent. Waste Eliminated.*
Vegetables:		*Poultry:*	
Asparagus	65	Broilers	33
Lima beans	56	Fryers	33
Brussels sprouts	50	Roasters	25
Broccoli	33	Duckling	30
Peas	66	Turkey	25
Spinach	48	*Meats:*	
Sea foods:		Sirloin (boneless)	40
Haddock (fillet)	66	Rib roast (boneless)	40
Cod (fillet)	66	Lamb fore roast (boneless)	33
Mackerel (fillet)	50	¾ lamb leg roast	25
Sole	75	Stewing lamb	44
Lobster meat (cooked)	80	Pork loin roast	17
Crab (cooked)	80	Steaks	15-25

"Z" Process

This process, which was described in the January issue of FOOD MANUFACTURE, was the subject of a paper by Mr. W. G. Brettell. Incidentally, it is one of the oldest of the processes as far as this country is concerned, having been in operation at Grimsby for some years.

The Haslacher Process

Not included in the symposium, but still another view on quick freezing, is the following description by Mr. A. B. Haslacher of the process of his devising:

The business of frozen foods has passed through its initial stage. At first the mere retention of foods in fresh condition for long periods was regarded as a miracle or a bit of clever legerdemain. It is no longer a stunt but is to-day a commonplace of everyday trade. To-day, in its secondary stage in the United States, the feat consists not in keeping the flavour and colour in the food but in keeping the dollars and cents in the profit column. Competition is keen, with new packers starting in many sections of the country. British packers are already faced with competitive offerings from America under the new trade agreement at prices about equal to English production.

Frozen and Canned Foods

To be a business in the true sense of the word, frozen pack must be capable of taking its place with other forms of food preservation, such as canning. Like canning, it must cater to the large masses of population and be within the price reach of millions of housewives. It is not sufficient to assert the flavour and colour superiority over canned goods. To achieve its true position, frozen pack must be taken from the semi-luxury class and made to approximate canned foods in price. By reason of its fresh taste and brighter appearance a slightly higher price may be obtained, but this difference must be kept slight if the business is to attain a worthwhile volume.

Provided an inexpensive process of freezing is followed, frozen foods can be manufactured at a cost commensurate with canned foods. High quality in frozen fruits and vegetables depends neither on low temperatures nor on the speed of freezing. The foregoing sentence sums up the opinions of the majority of Government and University research workers who have studied the subject. Such conclusions are worldwide and embrace expressions from leading authorities at the Low Temperature Laboratory of Cambridge, the United States Government Laboratories as well as various University stations. As regards fruits and vegetables, research men place far greater importance upon the quality and handling of the produce itself and upon the packaging, transport and final storage of the packed product than upon the mere form of freezing and temperature employed. Indeed, the United States Government laboratory at Seattle has proven that under favourable conditions a commercial pack of these items of high excellence in quality may be had at 12° to 15° F. There is a difference in the optimum rate of freezing between meat products and plant products, and the reason for this difference as well as the need for efficient application of freezing are well given in the following quotation from an address by Dr. M. A. Joslin of the University of California, delivered at the Sixth Conference of Pacific Coast Chapters, National Association, Practical Refrigerating Engineers, San Francisco.

Dr. Joslin's Opinions

"In meat products the dehydration of the gel is essentially reversible when the freezing is so rapid as to fix the original spatial distribution of the colloid. Quick freezing resulting in a uniform distribution of small ice crystals results in little destruction of texture, whereas in slow freezing irregular large ice crystals form and the colloid system is destroyed.

In plant products, because of the presence of inelastic cell walls, the presence of relatively large amounts of colloids capable of producing gels on simple contact with water, the separation of water as ice is usually largely irreversible. Consequently the rate of freezing has but little effect on the texture of most vegetables, although in some cases, particularly asparagus, rapid freezing is necessary as the maximum retention of structure is not as great as in quick-frozen meats.

The desired rate of freezing of fruits and vegetables may be attained by the use of more efficient systems of freezing as well as by the use of low temperatures. There is some evidence that exposure to very low temperatures results in a greater disorganisation of texture for certain fruits with consequently a more rapid and intense discoloration on defrosting. At present no data on the separate effects of rate of freezing and low temperature are available.

In most of the investigations reported so far, the rate of freezing has been increased by decreasing the temperature only. It is possible to increase the rate of heat transfer from the product by other means as well—*e.g.*, better contact with refrigerant, the use of a refrigerant of higher heat capacity, by proper motion of refrigerant about the product to be frozen so as to reduce film effects to a minimum, exposing a greater surface of product to be frozen per unit volume, etc. . . ."

Costs Reduced

By efficient application of moderately cold temperature production costs may be lowered so that frozen foods may compete with canned goods. This is the only possible way in which costs may be brought down. Raw material (produce) costs the same, whether it is to be canned or frozen, regardless of what method of freezing is used. Similarly the costs of preparation of produce are generally the same for all. Container costs are practically the same. Therefore it follows that the only scope for bringing down costs lies in the employment of a system of freezing at low cost. The Haslacher process, by using circulating brine within a tank with close contact and good conductivity, brings about high efficiency and low cost. The principle is that of common ice manufacture, the lowest cost known in freezing. Electric

current required to freeze 1 ton of vegetables by the Haslacher process under ordinary British conditions amounts to but 2s. Labour involved in the freezing operation comes to 2s. more, making a total of 4s. cost as direct charges for freezing 2,240 lbs. of finished product.

The Process

The Haslacher process is briefly described as follows: After the produce is properly cleaned, blanched and sorted, it is given a pre-cooling by being slowly propelled in a stream of ice water through pipes of large diameter. These pipes are kept chilled by being immersed in a tank of circulating brine at 30° F. The stream may be regulated as to length of run and as to velocity, so that upon emergence the produce is thoroughly cooled to a temperature between 35° and 40° F. This pre-cooling is of great importance. As it slowly moves in its icy bath, the produce, acted upon by the cold brine on the pipes, quickly loses its heat. Within a few minutes it is close to the freezing point. Bacterial action is inhibited. The substance of the fruit or vegetable becomes firm under the action of the ice water in a way familiar to canners.

Upon emergence the produce is carried over screen shakers to rid it of water. In order to provide a dry pack, all surplus water is removed and the produce conveyed to packing stations. The ice water is not wasted, but is returned to the forepart of the operation, where it is used in the preliminary cooling wash. Packaging is done in pliofilm bags, which are encased within paraffined cardboard cartons. As fast as these are weighed and filled they are placed on a conveyor which carries them to the freezing room.

This room is similar to a common ice plant in appearance. Freezing is done within large cans, which are kept lowered within the circulating brine in the tank. The packages are conveyed on to a cross conveyor, which is easily movable and is brought into place so that the packages may be filled into the freezing cans. It should be noted that the capacity of the apparatus is capable of keeping pace with the best efforts of the packing station. One man will handle 1 ton of packed product per hour, and the capacity can be arranged to take care of any amount desired, up to 10 tons an hour or more if necessary. A special device is used in filling the freezers, not only in order to handle the product with speed, but also properly to position each package in the freezer. Every package is in direct contact with one or more walls of the freezer, the outside of which is bathed with circulating brine at 0° F. The result is a high rate of heat transfer, and, with the produce already close to freezing by reason of the pre-cooling, the remaining portion of the operation is soon completed.

When freezing is accomplished the packages are removed by means of the device mentioned and are conveyed by belts to another room, where they are placed in shipping cases. From here they go to final storage.

Conclusions

1. Frozen pack must justify its existence by careful production methods as to quality and cost.

2. Cost consideration is vital. To become a great business it must not be in the semi-luxury class, but, similar to canned goods, it must be placed within the price reach of the millions.

3. By employing an efficient process of freezing which is comparable to cannery cooking in cost this may be done.

4. This has been accomplished according to the claims of the Haslacher process through (*a*) automatic pre-cooling, followed by (*b*) tank freezing, wherein circulating brine makes for high-quality product at lowest cost.

CHEMICAL ENGINEERS' ANNUAL DINNER

THE seventeenth Annual Dinner of the Institution of Chemical Engineers was held at the Hotel Victoria, London, on February 17, 1939. A large and distinguished company were present, the loyal toasts being proposed by the President, Dr. William Cullen, after which Sir Alexander Walker, K.B.E., in a witty speech proposed the toast of the Institution of Chemical Engineers, which was responded to by the President, who in his speech regretted the importance now assumed by war explosives generally. Speaking as one who knew the terrible destruction caused by high explosive and incendiary bombs, Dr. Cullen felt that, although there were signs of a change of view in A.R.P. work, the question of protection against such explosives had been almost entirely neglected.

The President-elect, F. Heron Rogers, Esq., ably proposed the Guests, the responses being given by the Hon. S. M. Lanigan O'Keefe, C.M.G. (High Commissioner for Southern Rhodesia), and Gilbert S. Szlumper, Esq., C.B.E. (President of the Institute of Transport). The Hon. Lanigan O'Keefe spoke of Southern Rhodesia as a very young country, which owed a debt of gratitude to scientists and engineers, and Mr. Szlumper emphasised how the question of transport entered vitally into almost every branch of commerce and manufacture of to-day.

A graceful tribute to Dr. Cullen, given by Dr. Herbert Levinstein, and its response by the President, brought to a close a very successful evening, and the good wishes of the Institution are extended to Mr. F. H. Rogers, the new President.

Among those who accepted invitations were:

à-Ababrelton, Mr. and Mrs. R. R., Alliott, Mr. E. A., Alliott, Miss, Andersen, Mr. A. I., Astbury, Mr. and Mrs. S. J., Auld, Lieut.-Col. and Mrs. S. J. M., Ballantyne, Mr. and Mrs. Horatio, Barber, Mr. and Mrs. C., Barnes, Mr. and Mrs. L. L., Beaver, Major G. D. C., Beaver, Mr. Hugh, Binnie, Mr. W. J. E., Board, Mr. and Mrs. T. F. A., Boyle, Miss Nora, Bramson, Mr. M. L., Braunholtz, Dr. and Mrs. W. T. K., Briggs, Colonel E., Bryden, Mr. Ewan, Buchanan, Mr. A. P., Cadman, Captain W. H., Calder, Mr. W. A. S., Callingham, Mr. and Mrs. W. E., Campbell, Mr. R. E., Carnegie, Mr. and Mrs. Francis, Chorlton, Mr. A. E. L., Chorlton, Miss Yvonne, Clark, Mr. and Mrs. E. Graham, Clark, Mr. F. W., Connor, Dr. J. M., Coulson, Dr. J. M., Crosbie-Walsh, Mr. T., Cullen, Dr. and Mrs. William, Darwin, Dr. and Mrs. C. G., Davidson, Major-General and Mrs. A. E., Davis, Mr. Eric N., de Whalley, Mr. and Mrs. H. C. S., Dixon, Engr. Vice-Admiral Sir Robert, Donald, Mr. M. B.,

(*Continued on page 96*)

ARTIFICIAL SAUSAGE SKINS

A New German Industry

Specially Contributed

THE MANUFACTURE of artificial sausage skins is the newest of the German food industries. Carried out by Naturin, this industry produces some 55,000,000 metres of artificial skins per year. Scrap which was previously destroyed or used for the making of gelatine is used as raw material. This includes bits of skin, tendons, inner skins of animals, and, in general, all the scrap from the slaughter-houses which contains albumin.

Preliminary Cleaning

This material is first washed thoroughly in long troughs, along which revolving wheels, similar to paddle wheels, are placed at intervals to mix the water and the scrap and effect a thorough cleaning. Once cleaned, the scrap is drained thoroughly and sent to treating vats. Here the scrap is treated with lime, to remove any meat which may adhere to the scrap, and then with dilute hydrochloric acid. This has the effect of decomposing the fibrous material and softening it.

After this treatment, the scrap, which has absorbed about 75 per cent. of water, is sent to a feazing roller, where it is cut up and reduced to a homogeneous fibrous paste. In order to ensure homogeneity, this paste is then passed through a mixing and kneading cylinder, where the mass is kneaded to render it suitable for use. In this process any excess water which may remain in the mass is drained out.

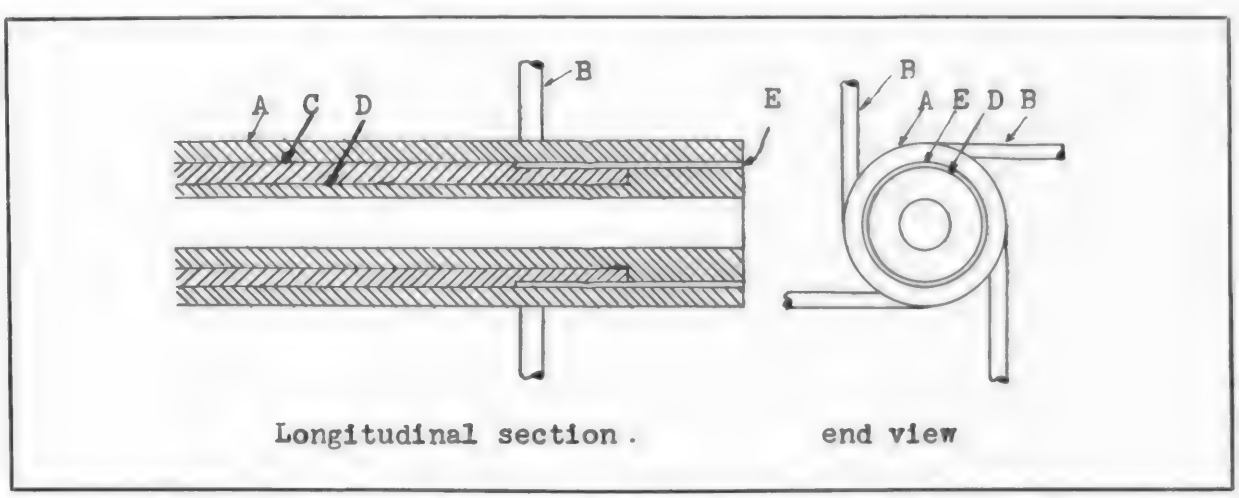
Making the Skin

The next operation is that of the actual making of the skin. This is carried out in a special nozzle. The pasty mass coming from the kneading cylinder is forced into this nozzle by four inlet tubes, (B), which enter its outer casing, (A) tangentially. The fibres in the mass naturally lie parallel with the tubes through which they are being forced and therefore enter the space, (E), in a circumferential direction. This space, (E), lies between the outer case, (A), and the revolving core, (C), and the fixed core, (D). It will be seen in the diagram that the end of the revolving core, (C), is ground down, forming a section of this space, (E), while the end section of the fixed core, (D), is exactly the same outside diameter as the end of the revolving core, (C), which it necessarily prolongs, and therefore forms the second section of the space, (E).

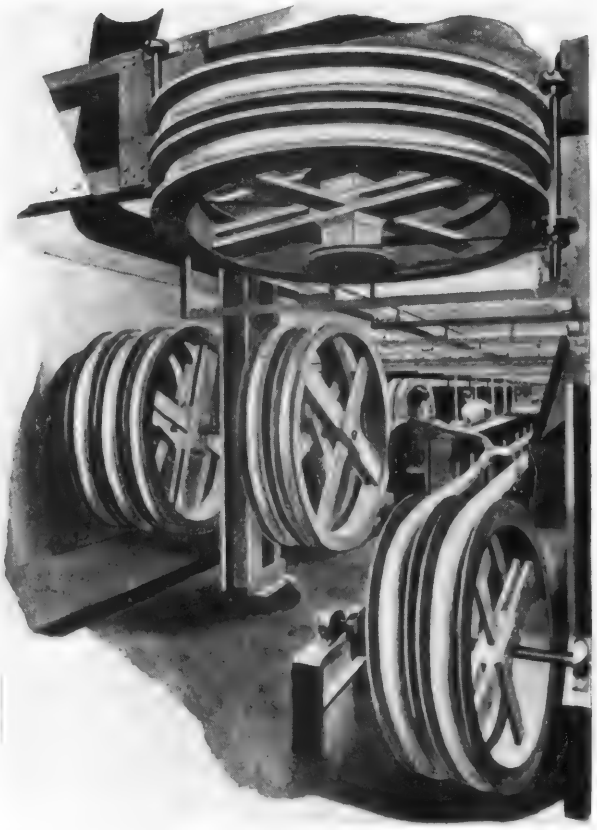
The rotation of the core, (C), tends to keep the fibres in the mass passing through the space, (E), in the circumferential position mentioned above. The skin moves on in the space, (E), towards the end of the nozzle under the pressure of the incoming mass, passing between the fixed case, (A), and the fixed core, (D). The friction of these latter causes the outer layers of fibre to move from the circumferential position to one parallel with the axis of the skin in formation. It will therefore be seen that the fibres in the outer layers of the skin are parallel with the axis of the skin, while the fibres of the inner layer lie in a circumferential direction. This ensures proper strength in both directions.

Drying and Toughening

The hot air which is admitted by the space, (F), in the centre of the nozzle, serves to dry the skin partly, and to keep it distended during the following manufac-



Diagrammatic sketches of nozzle used for the production of artificial sausage skins.



Drying room in which sausage skins, after treatment with aluminium sulphate, are dried in a current of warm air.

turing operations. As the skin leaves the nozzle, it runs through a solution of aluminium sulphate to toughen it, and to give it the proper resistance.

Final drying is carried out in a long chamber in which the skin runs over large wheels, while constant current of warm air in the room evaporates the last traces of moisture. During the dipping in sulphate and the drying, the skin is kept distended by the air blown into it through the nozzle, so that there is no danger of the sides sticking together.

After complete drying, the skins are cut into suitable lengths and examined for any defects before being wrapped in bundles ready for despatch.

Food Poisoning

(*Continued from page* 100)

Foods in Home

It is important to remember that investigations into outbreaks of food poisoning often show that the food purchased has not been consumed in a fresh condition, or that it has been heated up on the second or third day, or that it has been placed in an oven for a short period "to prevent its going bad" and not cooked and eaten until the following day.

In one outbreak which occurred in Staffordshire in 1930, there were 8 cases and 3 deaths. The poisonous pork pie was baked and sold on April 9, but was not consumed until April 13.

Jordan remarks: "Perhaps the most significant feature of food poisoning attacks is the frequency with which they have been traced to the use of raw or imperfectly cooked food."

Of 44 Continental outbreaks occurring from 1888 to 1910, 41 were due to the ingestion of meat foods. Meyer records that in Germany between the years 1923 and 1928 out of a total of 281 outbreaks in which the animal source of origin was determined, 168 were due to cattle, 60 to pigs and 49 to horseflesh.

(*To be continued*)

Chemical Engineers' Annual Dinner

(*Continued from page* 94)

Donovan, Mr. F. D., Drane, Dr. and Mrs. H. D. H., Dring, Mr. George, Drummond, Professor and Mrs. J. C., Duncan, Mr. and Mrs. Gordon, Edwards, Mr. E. B., Edwards, Mr. H. D., Ellingham, Dr. H. J. T., Evans, Mr. E. V., Evans, Mr. and Mrs. G., Eyre, Dr. and Mrs. J. Vargas, Fagan, Mr. and Mrs. J. W., Farrant, Mr. J. C., Fox, Dr. and Mrs. J. J., Fraser, Mr. and Mrs. Keith, Fraser, Mrs. M. M., Fraser, Mr. and Mrs. Norman, Gardner, Mr. and Mrs. W. Temple, Garland, Mr. and Mrs. C. S., Gloag, Major V. F., Greene, Mr. F. A., Hartley, Sir Harold and Lady, Harwood, Mr. and Mrs. F. Courtney, Hay, Mr. N. C. B., Hayman, Mr. and Mrs. C. G., Hayman, Mr. and Mrs. Roy F., Heastie, Mr. and Mrs. B., Hefter, Mr. R., Hewson, Mr. G. W., Hewson, Miss, Higgs, Mr. A. E., Himus, Dr. and Mrs. G. W., Hird, Miss J., Jackson, Mr. W. Lind, Jameson, Captain H. B., Jeppe, Professor and Mrs. B., Jones, Miss S. M., Jones, Mr. T. W., Jordan, Dr. and Mrs. L. A., Josephson, Mr. W. S., Kent, Mr. F. G., Lampitt, Dr. and Mrs. L. H., Leonard, Mr. and Mrs. Julian M., Levinstein, Dr. and Mrs. Herbert, Longhurst, Mr. C., Lymn, Mr. Arthur H., MacGregor, Mr. J., Mackie, Mr. C. J. T., McMillan, Miss M. M., Macnab, Mr. William Macnaught, Mr. and Mrs. R. M., March, Mr. Dudley, Mason, Mr. K. W., Masters, Major F. H., Mawer, Sir Allen and Lady, Miall, Dr. Stephen, Morgan, Sir Gilbert and Lady, Murray, Mr. D., Neilson, Mr. W. N., Newitt, Professor and Mrs. D. M., Newton, Mr. and Mrs. L. O., O'Keeffe, the Hon. and Mrs. S. M. Lanigan, Osborn, Mr. H. W. E., Oury, Mr. D. A., Parker, Dr. and Mrs. A., Patchin, Mr. and Mrs. G., Peel, Mr. and Mrs. F., Peel, Mr. P. R. E., Phipps, Mr. and Mrs. J. W., Pickard, Sir Robert and Lady, Pilcher, Mr. and Mrs. R. B., Pooley, Mr. and Mrs. H. J., Porteous, Mr. and Mrs. W. King, Potter, Mr. H. V., Pratt, Mr. J. Davidson, Preston, Dr. Wm., Reavell, Mr. and Mrs. J. Arthur, Reid, Mr. Alexander, Robertson, Dr. J. Hoy, Robinson, Mr. F. J., Robson, Mr. and Mrs. Stanley, Rogers, Mr. and Mrs. F. Heron, Rogers, Lieut.-Col. H. S., Ronca, Mr. J. F., Roper, Mr. C. G., Russell, Mr. and Mrs. William, Smith, Mr. and Mrs. H. C., Solavici, Mr. M., Steel, Mr. Henry A., Stein, Mr. and Mrs. E., Streatfield, Mr. E. L., Sully, Mr. Bernard D., Sutherland, Mr. John, Sutherland, Miss Joan, Swindin, Mr. and Mrs. Norman, Szlumper, Mr. and Mrs. G. S., Tait, Mr. J. H., Talbot, Mr. and Mrs. H., Taylor, Miss D., Thomson, Miss, Titterton, Miss Jean, Tongue, Mr. Harold, Tongue, Miss Edna, Toomey, Mr. W. E. S., Townsend, Mr. L. W., Turnbull, Miss, Underwood, Mr. A. J. V., Ure, Professor and Mrs. S. G. M., Vigers, Mr. and Mrs. B. E. A., Waddell, Miss R. M., Walker, Sir Alexander and Lady, Warner, Mr. F. E., Watkinson, Mr. H., Watson, Professor and Mrs. H. E., Webster, Mr. A., Wellman, Mrs. M., Windeler, Mr. George E., Woollam, Mr. J. P. V., Wright, Mr. J. W., Young, Mr. and Mrs. James, Zimmerli, Dr. and Mrs. W. F.

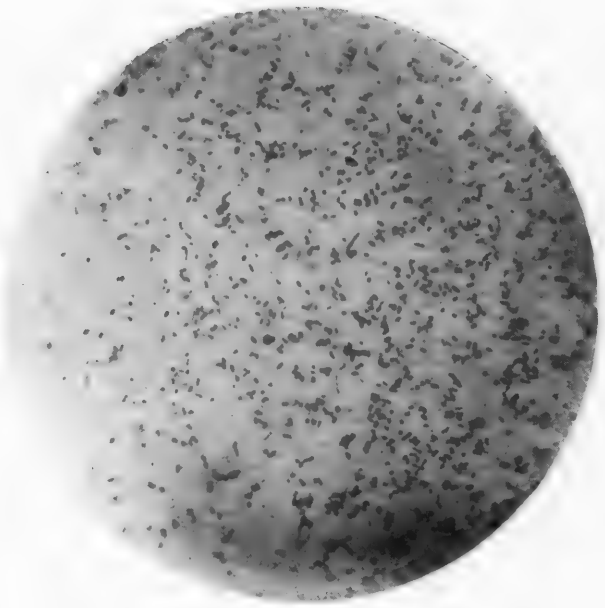
FOOD POISONING

PART V

FOOD-BORNE INFECTIONS

By ELLIOT B. DEWBERRY

M.R.I.P.H., M.R.San.I.



Bacillus aertrycke × 1,000 diam.

The micro-organism responsible for a large number of cases of food infection.

FOOD POISONING signifies illness due to the ingestion of some particular article of food or drink which contains either pathogenic bacteria capable of setting up inflammation of the alimentary tract (acute gastro-enteritis)—*i.e.*, food infection, or irritative poisonous substances (toxins) produced by the rapid multiplication of the various types of bacteria in the food or drink prior to ingestion—*i.e.*, food intoxication. These poisonous substances are usually heat-stable, and retain their potency even after exposure to temperatures sufficiently high to destroy the bacteria producing them.

Salmonella Group

In recent years the numerous investigations into food poisoning outbreaks, together with the intensive studies of the bacteria isolated (by Savage, Bruce White, Scott and other workers in this country and Jordan and his colleagues in America), have demonstrated that certain recognised types of the Salmonella group of organisms are the commonest cause of food infection. Certain bacilli of the dysentery group may sometimes be responsible for food poisoning.

The following shows the disease-producing rôle of some members of the Salmonella group:

Type of Organism.	*Man.*	*Animals.*
B. enteritidis.	Gastro - enteritis of food poisoning type.	Causes disease in cows and calves. Epidemics in rats and mice and sometimes disease in pigs, ducks and other animals.
B. aertrycke.	Food poisoning.	Widespread cause of enteritis in mice (*B. typi-murium*), guinea-pigs, and other rodents. Enteritis in parrots and other birds. Occasionally in pigs and as a cause of calf enteritis.
B. suipestifer.	Food poisoning, para - typhoid fever ("C" type).	Secondary invader in pigs in hog cholera, occasionally as a primary cause of pig infections.
Newport.	Food poisoning.	Dogs suffering from enteritis, otherwise unknown in animals.
Thompson.	Food poisoning.	Doubtful isolations from animals.
Derby.	Food poisoning.	Pigs, exact disease-producing rôle unknown.
Morbificans bovis.	Food poisoning.	Original strain from cows suffering from puerperal metritis.
Stanley.	Food poisoning.	Not yet isolated from animals.

The organisms of the above group, which can be distinguished by cultural or seriological tests, do not form spores and have no special resistance to heat. They multiply rapidly upon meat or other suitable foodstuffs, producing poisonous substances (toxins) which have a distinct resistance to heat. They can be isolated from animals which are apparently free from disease, but evidence favours the view that they are only present in the carrier state, a stage towards infection in a new host.

Savage and Bruce White studied the method of action of strains of this group upon the alimentary tract, and demonstrated the presence of a powerful irritant, both in boiled and unboiled cultures, which acts rapidly and intensively upon the mucous membrane of the stomach of young rabbits and was most readily demonstrable in those types within the group which were responsible for food poisoning.

Ubiquity of Salmonella Group

Outbreaks due to members of the Salmonella group are met with in many parts of the world. They are common in Europe and America, and cases have been reported from the widely scattered areas of Asia and Africa. In Great Britain food poisoning of the gastro-intestinal type is regarded as also synonymous with food-borne Salmonella infection and intoxication.

Infection Type

(*a*) Where the bacteria present in the food have not had time to elaborate poisonous substances and the illness results from the ingestion of food containing living bacteria only, and is preceded by an incubation period of between 6 and 24 hours.

The symptoms are of the gastro-intestinal type. Fever may also be present. In favourable circumstances the symptoms gradually disappear within a week or so. In severe cases marked prostration may continue for a considerable period. Long illness is probably due to penetration of the living bacilli into the internal organs, such as the liver and spleen and a fatal result may ensue.

(*b*) Where the bacteria have developed some poisonous substances in the food prior to its being consumed (*i.e.*, living bacteria and some toxins). In this case the incubation period will be somewhat shorter and the symptoms less acute.

Intoxication

Where the ingested food contains the poisonous substances (toxins) only.

The incubation period is very brief, usually half an hour to four hours. The general symptoms resemble those of the infection type, but are acute at the onset and often very severe, and prostration is greater; but with the gradual elimination of the poisons recovery is rapid and the acute effects may pass off within 24 hours. Such cases are rarely fatal.

It has been generally found that the interval between the consumption of the incriminated food and onset of symptoms varies considerably, not only in different outbreaks, but in the same outbreak and the severity of the attack with the amount of food consumed.

The following table, compiled from the annual reports of The Ministry of Health 1932-37, shows the number of outbreaks of food poisoning due to Salmonella infections and intoxications:

Year.	*Number of Outbreaks of Food Poisoning.*	*Number of Cases.*	*Number of Deaths.*	*Number due to Salmonella Infection.*	*Cases of the Toxin Type.*
1932	30	186		24	
1933	52	512	15	32	21
1934	46	125	6	43	26
1935	116	698	23	46	47
1936	76	224	3	19	26
1937	66	601	24	45	22

The organism most commonly isolated in British outbreaks is *B. aertrycke*. During the years 1923-33, the Ministry of Health found *B. aertrycke* in 110 out of 186 outbreaks; in 22 out of 43 in 1934; in 29 out of 46 in 1935; and 11 out of 19 in 1936.

The next organism most frequently isolated is *B. enteritidis*. Outbreaks due to this bacillus appear to be more common in countries other than England and tend to be more severe.

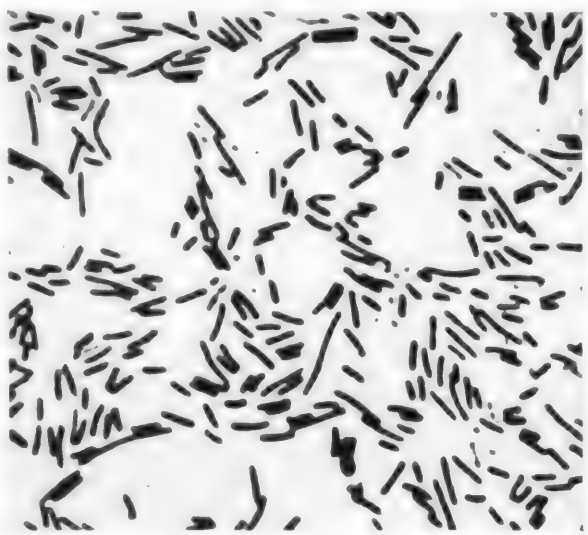
During recent years evidence has been accumulating to show that many outbreaks are due to the poisonous substances elaborated by organisms of the Salmonella group. The extremely short incubation period (2 to 4 hours), together with the very severe symptoms, suggest the action of a preformed toxic substance in the food.

Savage advanced this theory in 1920 and in 1932, when delivering the Sedgwick Memorial Lecture in America, said: "It is evident that we have to deal with an irritant toxic substance, almost certainly of bacterial origin."

The Edinburgh Outbreak

The following outbreak, which occurred at Edinburgh in 1926, is a typical example of this type of poisoning. Three persons consumed a mutton stew and were attacked, after a very short incubation period, with acute food poisoning symptoms. From the stew no "living Salmonella bacilli" could be isolated, but from part of the mutton not used to make the stew, a Salmonella strain was isolated which was pathogenic to guinea pigs.

Little is known, however, of the exact nature of these poisonous substances, whether they are specific bodies elaborated by bacteria or whether they represent the breakdown products of dead organisms. They are apparently non-poisonous when fed to most laboratory animals, although young Rhesus monkeys are said to be affected after a fairly large dose. Dolman, Wilson and Cockcroft (1936) suggest that interperitoneal administra-



Bacillus proteus vulgaris.

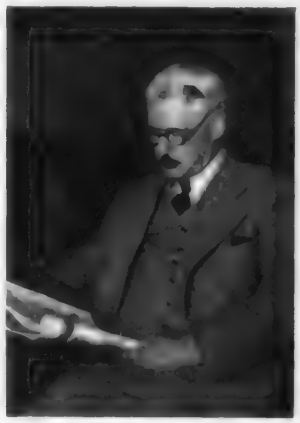
EMINENT BACTERIOLOGISTS

Prof. Theobald Smith (1859-1934)

was co-worker with D. E. Salmon in the "Salmonella" group of organisms.

Prof. F. Wilbur Tanner, B.S., M.S., Ph.D.,

Department of Bacteriology, University of Illinois, U.S.A.



R. W. Dodgson, M.D., M.R.C.P., M.R.C.S.,

under whose direction the experiments on mussel and oyster purification were carried out.

Karl F. Meyer, M.D.,

the leading authority in the U.S. on anaerobic bacteria.

tion to kittens may be a more reliable method of detecting toxins than administrations by mouth to monkeys.

Cathcart found that *B. enteritidis* toxin withstood heating to 100° C. for 30 minutes.

Heat Stability

The remarkable heat-stable properties of these poisonous substances have considerable bearing on the processing of canned foods. Savage remarks upon "the close association of this type of food poisoning with canned foods—that is, foods strongly heated after they are put into the tin. The temperatures used (100° C. or above) are adequate to kill non-sporing bacilli, but Salmonella toxins can survive these temperatures. Assuming specific infection, before canning, of a portion of the food, the conditions actually found—that is, a food perfectly sound physically, freedom from living pathogenic bacilli, the presence of resistant toxins—are just those one would expect".

Thermal Death Point

A considerable amount of research and experimental work has been carried out in this country, in America, and in Germany to ascertain the thermal destruction point of toxins. This probably varies through a wide range of temperatures and is dependent moreover on several factors, including the character and composition of the contents of the can; the hydrogen-ion concentration and the nature of the toxin itself. In canned foods the heat penetrates to the centre of the contents by convection and conduction, but the character of the food greatly affects the convection currents. In thick and solid substances such as meat, the heat, being by conduction, penetrates very slowly. Therefore it is necessary that canned foods should be submitted to a sufficient high temperature for the required length of time to be certain of the destruction of any bacterial toxins that might be present; it is also essential that no overheating takes place, otherwise the food may be spoiled.

Beveridge and Fawcus carried out some interesting experiments on the penetration of heat into the substance of meat in cans. They found that when a tin was simply boiled in water the centre of the meat did not reach 100° C., even after five hours, and that with higher temperatures the undermentioned results were recorded:

Outside Temperature.	*Size of Tin.*	*Time taken by Central Thermometer to Reach*		*Number of Experiments.*
		100° C.	105° C.	
107° C.	1 lb.	58 mins.	80 mins.	Average of 5
107° C.	2 ,,	95 ,,	123 ,,	,, 5
120° C.	1 ,,	22 ,,	24·4 ,,	,, 5
120° C.	2 ,,	28 ,,	36·2 ,,	,, 5
130° C.	2 ,,	17 ,,	22 ,,	,, 2

With larger tins the rate and time of heat penetration would be considerably longer.

With regard to liquid foods, such as soups and beverages, the heat being by convection, penetrates very rapidly and providing they are boiled for a sufficient time, no doubt destroys infectivity. This is well illustrated in an outbreak at Newcastle in 1913 where 523 people consumed milk infected by *B. enteritidis*, and not a single person who drank the milk after it had been boiled was infected.

Staphylococcus Infection

Regarding poisonous substances produced by other than Salmonella organisms, the recent experimental work by Jordan, Burrows, Dack and Woolpert, in America, upon staphylococci and other bacteria, has raised the question as to whether some outbreaks may not have

Bacillus enteritidis (Gaertner).

been due to this type of food poisoning. The incubation period is short and symptoms almost similar, and the observers suggest that the toxic substance is not completely destroyed by exposure for 30 minutes to 100° C. Jordan remarks: "It is as yet uncertain how frequent the staphylococcus type of food poisoning really is. Probably it has occurred much more often than generally recognised. During the past few years material from suspected food poisoning outbreaks has been frequently examined without the discovery of any organisms of the Salmonella group."

The Chief Medical Officer of the Ministry of Health in his annual report for 1936, in recording toxin outbreaks, says: "Of the remainder, 26 were regarded, from the clinical course (very acute gastritis and enteritis within three hours of a suspected meal, followed by rapid recovery), as due to a 'toxin' already elaborated in the food as a result of bacterial growth and not due to Salmonella infection. From the suspected food, cultures of staphylococci, usually aureus, were isolated in 10 instances, in such numbers as to suggest that they had produced the gastro-intestinal irritant responsible for the symptoms. In one instance (canned tomatoes) heat-resistant streptococci of the fæcalis type were present in great abundance and almost pure culture."

Types of Food that Act as Vehicles of Infection

The suitability of a food as a medium for the multiplication of the organisms of the Salmonella group is of considerable importance. It has been observed that meat and meat products, especially made-up or manipulated foods, have proved to be the commonest classes of foodstuffs that act as vehicles of infection.

The following table gives the vehicles in 121 food poisoning outbreaks (Great Britain, 1919 to 1931) associated with presence of living Salmonella strains:

Milk and milk products (milk 5, cream 1, ice-cream 3, junket 1, trifle 2)	12
Meat pies (pork 10, veal and ham 3, various 3) ..	16
Minced meat foods (minced or potted 8, brawn 6, sausages 3, stuffing 1, others 3)	21
Canned foods (beef 2, salmon 4, fruit 2)	8
Manipulated foods (salted beef 2, pressed beef 2, meat stews 2, ham 2, bacon 2)	10
Eggs (duck 6, egg sandwiches 1)	7
Fresh meat (pork 2, beef 1, mutton 2, veal 1, unspecified 2)	8
Various (fried fish 2, shellfish 2, other 1)	5
Not ascertained with reasonable certainty	34

Vehicle in 70 "toxin" type of food poisoning outbreaks in Great Britain, 1911-31.

		Outbreaks.
Tinned foods (82·9 per cent.) ..		38
Tinned beef	26	
,, mutton	1	
,, tongue	9	
,, salmon	13	
,, sardines	2	
,, herrings	2	
,, shellfish	3	
,, peas	2	
Made-up meat foods		5
Fish paste	1	
Brawn	2	
Veal and ham pie	1	
Sausage	1	
Less manipulated meat foods ..		5
Salted beef and pork	1	
Pickled tongue	2	
Pressed beef	1	
Frozen meat	1	
Other foods		2
Cheese	1	
Cooked beef	1	

The Salmonella infections during 1926 included an outbreak of 130 cases due to infected milk.

It must be borne in mind that foodstuffs such as meat pies, brawn, pork pies, etc., which contain a considerable amount of jelly or solution of gelatin or agar-agar, after being prepared, are allowed to stand for some time to cool slowly. Such foods constitute an excellent medium for the growth of organisms which have many hours at a suitable temperature in which to multiply rapidly; moreover, preparation and cooling may take place under conditions where infection is likely to occur. Lastly, though probably not of least importance, the meat used may be diseased or unsound.

Savage (1931) says: "Again and again the facts show that the original food was harmless and the infection with the bacillus takes place on the premises. It is very significant that in many outbreaks the food sold first causes no illness, although the facts suggest that it is already infected, while the food which is sold last—that is, allowing a long period for the multiplication of the Salmonella bacilli—is the most poisonous, causes the most severe attacks and includes fatal cases."

(*Continued on page* 96.)

SCIENCE FOR BUTCHERS

The Science of Meat, *E. C. Line, B.Sc.(Lond.). Vol. I. Pp. xii+576. London.* 10*s. net. Vol. II. Pp. viii+*270. 7*s. net.*

Report for the Year 1937-38, *Department of Scientific and Industrial Research. Pp. iv+*203. *London.* 3*s. net.*

TO ONE not unfamiliar with the subject the mere name of the book awakens special interest. It is in two volumes, the second consisting of a sort of overflow as if the author had been troubled with *embarras de riches* as regards matter.

The preface to the first volume contains a graceful tribute to Mr. W. H. Nevell, " the father of technical education in the meat industry ", who recently retired from the directorship of the Smithfield Institute through ill-health, but whose name will always be honourably associated with the excellent work he developed.

Science for Butchers

At the time of the opening of the Smithfield classes the idea of science for butchers was treated as " something of a joke ". Mr. Line might possibly have been less general when he says that " if the butcher is to maintain or extend his sales in face of the manifold activities of the cooked food man, the canner, the crank and the vegetarian, he needs to be a powerful and persuasive talker and an acute propagandist ". But possibly the members of the anti-meat class may have their unindicated grades of sinfulness?

Mr. Line's task in one sense has been one of relative simplicity—that is, to write an educational book to conform to a syllabus; a textbook deliberately written to prepare students for a specific examination, for the Diploma of the National Federation of Meat Traders.

From another angle the author's work has been more difficult. It has been to support a specialised subject with the irreducible minimum of accessory subjects; in this case, to impart to minds to a large extent unprepared the intricacies of chemistry and biology, in simple language, with, as the author says, " the elimination wherever possible of long words ". There has been a tendency to essay a similar task in food books during the past few years. Can it be done satisfactorily? It is probable that the length of the list of holders of the diploma aforementioned might suggest that the reply in the case of this book must be in the affirmative, but is this necessarily the true criterion?

Biology and Chemistry

To one familiar for long years with what the author has termed " biological and chemical preliminaries " it is difficult to gauge the possibilities of their satisfactory absorption in minds already replete with school subjects but in many cases unversed in scientific notions.

However, Mr. Line's attempt is a valiant one, and it certainly is not for the present reviewer to say that it does not serve its purpose, which presumably is not only to prepare the embryo butcher for his diploma examination, but to imbue him with considerable culture, which the author hopes " will serve him to counter the competition of better organised rivals ".

Volume I. deals with general biology, anatomy and physiology of animals. Also disease and meat inspection. Mr. Line has covered an enormous amount of ground in a lucid and interesting way. The 184 illustrations are excellently chosen, and there is a useful index and bibliography.

The second volume is concerned with a large range of subjects such as dietetics, nervous system of animals, reproduction, genetics, heredity and animal breeding, post-mortem physiology of meat, etc. The author has gone somewhat astray in his discussion of nitrate and nitrite as " preserving agents ". He also ignores the fact that nitrite is not permitted in this country as a reagent in curing when he says that " persons interested in the nitrite cure would be advised to experiment on a small scale before attempting this method." As the law stands to-day, they must not experiment, or rather must not put their experiments into practice.

Tendering of Meat

It would be excellent if butchers were to read, mark, learn and inwardly digest the chapter on producing tenderness in meat. English meat would be more acceptable to the consumer were its hanging period lengthened, although economic considerations obtrude in this matter, and the smaller butcher at all events may be forced to turn over his stock too rapidly to permit of storage.

The meat industry must feel a debt of gratitude to Mr. Line for the part he has played in raising the standard of knowledge in a very important section of the food industry.

Food Investigation

The annual report of the Department of Scientific and Industrial Research covers an amazing amount of ground, much of which is without the scope of this Journal. But in the special sphere of food a large volume of work has been done.

It is curious to think that ten years ago there were no gas stores. To-day they provide three million feet of storage, and this is only a beginning.

In the last few years the problem of the preservation of fruit, in particular home-grown varieties which respond badly to ordinary cold storage, has been solved by the development of a new method called " gas storage ". In principle the method depends on adjusting the ventilation of cooled stores so that their atmosphere contains just the right amount of carbon dioxide, this carbon dioxide being breathed out by the fruit itself.

The problem of bringing chilled meat from Australia and New Zealand has, as the result of the Department's work, been solved by the use of special chambers enriched with carbon dioxide gas. The result has been that during 1937 those countries sent some three-quarters of a million hundredweights of chilled beef to Great Britain.

Fish is another article of diet which responds to gas storage treatment to such an extent that lemon soles have been stored for two years and were in excellent condition at the end of that period. The extent of this achievement may be gauged by the fact that fish, as ordinarily handled and stowed in crushed ice, cannot be kept really fresh for more than ten to twelve days.

Canning

Although some work has been done on canned foods and bacon, in the main the problems of the processing of food, curing, canning, jam making, etc., have been regarded as less pressing than research required to bring fresh food to the consumer in the best possible condition. The report states, however, that " the Food Investigation Board is to

be invited to review the whole field of research into the processing of foodstuffs and to submit proposals for embracing under their scientific supervision such work in this field as they may consider desirable in the national interest."

Flesh Foods

The work on electrical resistance as a measure of *post mortem* acidification has thrown much light upon factors governing the keeping qualities of meat. In addition to its effect on these properties, the production of acid is of importance in determining its consistency and appearance.

Reference is made to a special report by C. H. Lea on rancidity of edible fats, in which rancidity in dairy products and the fat of meat and fish are specially considered.

Examination of the bacterial flora of eggs suggests that in most cases rotting is the work of a few genera of micro-organisms which commonly occur on the shell and the mechanism of the production of rots resolves itself into a study of the penetration of the shell by these organisms.

In connection with pork, bacon and hams, investigation has been conducted on the composition and structure of the fatty and muscular tissues and the factors which affect them, upon which the quality of bacon depends.

A curious fact in connection with curing is that a respiratory enzyme, when extracted from the cell, becomes much more resistant towards salts. The reason for this fact is being sought. A simple equation has been found that may be applied to express the activity of the enzyme in the presence of salts. This equation also relates the rate of respiration by bacteria to the concentration of salts in the solution in which they are suspended.

A number of papers on fish investigation are cited. It has been shown that the fat of herring varies seasonally in composition.

Eels are now being fed with ethyl esters of individual fatty acids, in the hope of obtaining direct proof of the hydrogenation and dehydrogenation of fat.

The more precise localisation and possible function of Vitamin A in the alimentary tract of certain fish, particularly the halibut, is being studied.

By fractionation with ammonium sulphate a solid, highly active and preservable preparation has been made of the enzyme responsible for the development of fat peroxides during storage—a valuable item of investigation.

Results obtained from experiments made with the object of seeking chemical indices of relative freshness of fish give promise that the dimethylamine and trimethylamine content may constitute such indices.

Fruit and Vegetables

Reference is made, among a great volume of work on gas storage of fruit and vegetables, to that done at the Ditton Laboratory on Cox's Orange Pippins.

Further studies on the respiration of apples has brought to light a new fact of some practical importance in gas storage. In the stage before the attainment of full maturity at which they are often gathered, apples exhibit, on exposure to concentrations of carbon dioxide up to 15 per cent., a temporary increase in activity which may amount to as much as 100 per cent. Thus, in all forms of cold storage, both on land and at sea, the possibility of carbon dioxide accumulating to dangerous levels is greater in the period immediately after the fruit has been placed in store than has been hitherto thought possible.

Quick Freezing

Results obtained with peas directly immersed in sodium chloride brine at −4° F. were excellent. It is considered that this method of freezing should have valuable practical application, not only for freezing vegetables, but also, with suitable modifications of the freezing medium, for fruits.

The foregoing is only a slight indication of the extraordinarily interesting work described in the report, to which the reader is referred for full details.

T. C.-W.

Canadian Agriculture Fosters Meat Packing

Slaughtering and meat packing is one of the most important of Canadian industries, alternating yearly between second and third places. According to the latest completed annual statistics embodied in the 1937 report of the slaughtering and meat packing and sausage and sausage casings industry in Canada, the combined quantity of the various kinds of meats sold fresh (beef, mutton, lamb, pork and veal) was 755,025,021 lbs. in 1937, compared with a total for similar items in 1936 of 725,109,140 lbs., and of 628,450,936 lbs. in 1935. Other principal items which show increases in quantity of product are hams, shoulders, bacon and sides, cured meats, sausage (fresh and cured), sausage casings, and cooked meats.

The value of sales of the industry's products has mounted steadily during the past four years, and in 1937 it reached a total of $181,419,311, an increase over the preceding year of $24,447,671, or 16 per cent., and an increase over 1935 of $48,039,999, or 36 per cent.

The total cost value of the animals slaughtered and the miscellaneous materials used by the industry in 1937 was $148,057,651. This total comprises $118,451,926 as the value of the animals slaughtered; $11,623,743, the dressed meat purchased fresh, or partially cured; $2,317,271, the value of the poultry; and $15,664,711, the value of other materials, such as vegetable and animal oils, sugar, salt and spices. The total number of animals slaughtered by the industry in 1937 was 6,518,065, with a total dressed weight of 11,516,492 cwt.

Canned meats, poultry and soups, mince-meat, lard, shortening tallow, neat's foot and several other oils, stearine, canned dog food, stock and poultry feeds, cracklings, grease, animal tankage, raw and ground bones, complete fertiliser, hides, wool and hair are among the many other products of the industry. The number of slaughtering and meat-packing plants in operation in Canada in 1937 was 138.

Bakers' and Confectioners' Exhibition

The Schedule of Competitions to be held at the Bakers' and Confectioners' Exhibition from September 2 to 8 next is now being formulated, and the Committee will meet shortly to consider suggestions, offers of prizes, etc. Should any member of the trade, particularly past competitors, have any suggestions to offer, it is hoped that these will be sent to the managing director, Mr. H. S. Rogers, 11, Queen Victoria Street, London, E.C. 4, as soon as possible.

CORRESPONDENCE

The Editor.

Dear Sir,

On page 51 of your current issue you have photographs of a can of veal from Parry's expedition to the Antarctic in 1824 and also of apparatus that was used to open this can. May I point out that both photographs were taken in connection with an investigation of this and other tins of historical interest which was recently undertaken by Mr. Macara, Mr. Lewis, Professor Wilson and myself, and that it is incorrect to state that the opening took place in 1868.

Yours faithfully,

J. C. Drummond.

University College.

The illustrations referred to by Professor Drummond were incorrectly described and the facts are, of course, as stated in the above letter.—Ed.

NEWS FROM THE INDUSTRY

Housewives Take Precautions

A flood of enquiries for copies of the bulletin of the Canned Foods Advisory Bureau guiding housewives in the home storage of foods against emergency comes as a result of the recent statement by the President of the Board of Trade in the House of Commons.

One million have already been issued. It is estimated that a further half-million will be despatched by the middle of next week.

Applications are pouring in not only from housewives, but from A.R.P. centres; borough, urban and district councils; boarding houses; Red Cross Organisations; schools; coal mines; gas and electricity undertakings; factories, and food distributors of all kinds.

Grocers who have been in communication with the Bureau report increased purchases of canned foods.

* * *

Oil of Peppermint and Spearmint

President of the A. M. Todd Co., of Kalamazoo, biggest primary market dealers in American oil of peppermint and spearmint, Mr. A. J. Todd arrived in London early in February on a fortnight's visit.

In an interview with our contemporary *Food Industries Weekly*, he said, "For many years we have supplied the English market with much of its oil of peppermint, and I am simply here to pay my respects to our clients."

Great Britain bought last year over 20 per cent. more American oil of peppermint and spearmint than in 1937. With purchases of 346,172 lb. in the first 11 months of 1938—40,000 lb. up on the previous year—this country is easily the best customer of the Michigan and Indiana areas, which produce 85 per cent. of the U.S.A.'s peppermint.

Consumption has risen largely and steadily for a decade, chewing-gum manufacture providing by far the largest outlet.

Wet distillation of the oil is a process so simple that little scope is provided for technical improvement, but, according to Mr. Todd, the last few years have seen "an upward surge" in meeting a demand for higher standards of quality.

Before returning to the States in the *Ile de France* on March 8, Mr. Todd will visit the firm's agents in Hamburg and Paris. Business in this country, however, unlike the Continent's, is transacted on the basis of direct shipments from America.

* * *

Texas Canning of Vegetable Juices

The Lindsay-Niles Canning Company, situated near Mission, Texas, expects to process vegetable juices from 2,500,000 lb. of carrots and beets this season, according to officers of the firm. Thus the output of the plant will be more than four times what it was last season. It is reported to be the only industry of its kind in the United States, in the matter of processing carrot and beet juices on a commercial scale. Juices of other vegetables, however, have been on the market for several years.

The Lindsay-Niles plant started operations for the season on December 15 and will continue to the middle of April. Arrangements have been made for distributing the juices extensively through retail grocers and health food stores in Texas, Oklahoma, Kansas, Arkansas, and Alabama. The juices are sold in quantities in California, Illinois, and Pennsylvania. The firm has 1,500 outlets in Texas alone and about 750 in other parts of the United States. The juice has been shipped from the Lower Rio Grande Valley to Canada, Mexico, and the British Isles. It is not at all unlikely, officials say, that packing of vegetables may solve the problem of surplus fresh vegetables in a relatively short time.

One hospital has been sold 1,100 cases and the cannery has contracted to deliver to another 2,500 in each month of January, February, and March. One firm in Illinois has ordered 6,500 cases under a private label.

* * *

320 Acres for Industry

Conceived as a means of helping the distressed areas, a great new factory estate has sprung up at Hillington, just outside Glasgow. It

New Shelter for A.R.P. Personnel

Before — After

These shelters, made from heavy splinter-proof steel plate, have been produced by Constructors, Ltd., of Birmingham.
They were tested on February 9, in Birmingham, for the benefit of Home Office and War Office representatives, M.P.s, civic chiefs, heads of Police and Fire Brigades from all parts of the country, members of A.R.P. committees and leading industrialists.

is controlled by Scottish Industrial Estates, Ltd., a non-profit-making company financed by the loans of the Special Areas Fund. Thus the tenants pay rents which cover the loan charges and the administrative expenses of the estate—but no landlord's profits.

By paying a rent of £1 per week a small manufacturer can have excellent facilities for work and staff welfare which confound the notion that such are only for the biggest and wealthiest firms.

The estate is situated on the south-west edge of Glasgow at the side of a railway and near the George V Dock. It occupies about 320 acres of land, and just now the first 50 acres are being developed. Nearly £1,000,000 was spent in the first two years of the estate's existence; 80 factories have been let and about 1,500 people work in them. Thus the unemployment bugbear has been relieved to some extent, although much more of the estate must be worked before prosperity returns to that area.

The possibilities of trade within the estate are extensive. Industries as diversified as aerated waters and non-ferrous tubes are among those in the estate's factories; between them are many trades complementary to each other.

* * *

Food Tableting

Not long ago practically all the tablets produced by the machines of Manesty Machines, Ltd., were for medicinal use. But to-day lemonade and fruit drink tablets, soup cubes, cocoa, tea, coffee, dried milk tablets and catalyst tablets are all made on these machines.

The standard machines range from small hand-operated models to large rotary type machines which produce 1,500 tablets per minute. They are described and illustrated in a new catalogue. Another catalogue received at the same time describes the firm's automatic water stills for the supply of distilled water.

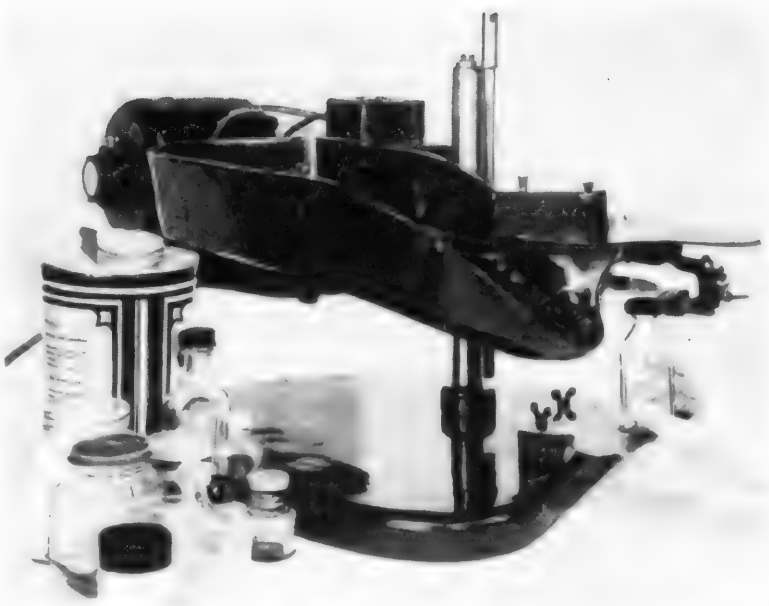
* * *

Dermatitis Poster

A poster has just been issued by Messrs. Sternol, Ltd., warning the public against Dermatitis.

The poster is strikingly set in red, white and blue, advertising and urging the use of Sternocleanse against the scourge of Dermatitis.

This poster is to be displayed on works notice-boards in order that workmen may be encouraged to make full use of Sternocleanse provided by the management.



New Machine for Closing and Tightening Screw Caps

One of the latest types of machines for applying and tightening screw caps fitted to glass and other containers is a British made model just put on the market under the name of "Universal". An important feature of this machine is that it effects the dual operation of screwing and tightening in one, thereby saving a considerable amount of time and expense and ensuring that all bottles, etc., are uniformly closed and tightened; any risk of splashing or spilling of the products while being handled in the factory or in transit is thus eliminated.

In addition to this advantage the machine can handle bottles, jars or containers of any size without the necessity of changing any of the machine parts. The only thing which has to be done when changing from one size of container or from one cap to another is to adjust the machine to the proper height and diameter of the cap. This, together with the desired degree of tightness, can be achieved in a few seconds and the machine continues running without any disturbance.

The machine is a very compact unit and can be placed anywhere and on any bench, whilst it can be operated from any electrical point with a $\frac{1}{3}$ h.p. motor. It is one of the productions of Richard Brandt Automatic Machines, 27, Percy Street, London, W. 1.

* * *

Agreements Terminated

Messrs. Robert Kellie and Son, Ltd., write: Will you please note that we are terminating our agreement with Messrs. Chas. E. Douglas and Co., Ltd., and on and after June 1, 1939, they will no longer represent us in London and the South of England?

Until new arrangements are made, of which you will receive notice, all enquiries will be dealt with from the head office here.

Messrs. Heat and Air Systems, Ltd., of 172, Buckingham Palace Road, S.W. 1, announce that after April 17, 1939, they will not be restricted to the use of U.S.A. refrigeration equipment in their design of air-conditioning plants, their agreement with Messrs. Westinghouse Electric International Co. of New York, being terminated on that date.

Novel Electrical Contractors

Hotwire Vacuum Switches are devices with many advantages. These are used extensively in conjunction with toluene regulators and other control devices for accurate regulation of temperature, humidity, etc.

It is an electrical contactor which possesses many novel and useful features. The contacts cannot oxidise or arc, and the whole mechanism is protected against external atmospheric conditions and moisture. The hotwire vacuum switch operates without modification on A.C. or D.C.; it is absolutely noiseless and produces no vibration. Small in size, it can be mounted in any position.

This novel device is a product of Messrs. Sunvic Controls, Ltd., Stanhope House, Aldwych, London, W.C. 2.

Ultra-Violet Water Steriliser

The sterilisation of water by passing ultra-violet rays through it (after preliminary filtration) has long been known and extensively used, although it was necessary to use quartz mercury arc burners of complex shape, cumbersome and fragile to handle, capable of operating only in the horizontal position, and requiring hand-tilting to start.

In the Hanovia water steriliser, a new machine, these drawbacks are overcome. The quartz mercury arc tube used acts on the new high-pressure electronic discharge principle, operates in any position, is very simple in shape, and starts automatically. In the steriliser it is surrounded by a quartz jacket, which in turn forms the core of a well-designed metal container. The water for treatment, after being clarified in a filter, is admitted at the base of the container and flows in an upward swirl around the annular flow chamber in a layer 1 inch thick. The chamber has a height of 7 inches and a capacity of $2\frac{1}{4}$ pints. The steriliser is designed to give an output up to 600 gallons per hour, so that normally the water is exposed for $1\frac{1}{4}$ seconds. While this rate of flow can be reduced to any point desired, it has been found by extensive bacteriological tests that pathological organisms such as *B. coli*, the typhoid bacillus, soil bacilli, etc., are destroyed even in heavy concentrations at this rate of flow. Other injurious organisms—*e.g.*, the acidifiers and proteolytes which produce rancidity in butter, the sarcina, lactic and acetic acid producing organisms detrimental in brewing—are likewise destroyed.

Advance models have shown a practical use in breweries, butter factories, mineral-water plants and specialised branches of industry.

Light in Industry

Lighting in the food industry is becoming an increasingly important factor.

Messrs. C. Shippam, Ltd., the well-known potted meat and fish specialists of Chichester, have adopted a special system of General Electric Company lighting in a section of their factory devoted to the filling of containers.

Hitherto, the main lighting difficulty had been that reflections on the capsules of the containers militated against expeditious handling.

The G.E.C. have overcome this by a system of indirect lighting, employing pendant fittings equipped with Osram lamps. This provides a high standard of uniform illumination totally devoid of glare or reflections.

* * *

Tinplate Corrosion Facts

A method of calculation to assess the area of basis steel exposed at pores in the tin coating on tinplate has been worked out by W. E. Hoare, B.Sc. The calculation is based on the results of an experimental investigation of the effect of thickness of the tin coating on porosity, and on theoretical work on the size of non-reactive areas necessary to produce normal pores.

The method, described in a recent issue of the *Philosophical Magazine*, is of value to research workers studying the corrosion of tinplate. This paper has now been issued in pamphlet form as publication No. 86 of the International Tin Research and Development Council.

Copies of this pamphlet can be obtained on application to the Secretary, International Tin Research and Development Council, Fraser Road, Greenford, Middlesex.

* * *

Special system of lighting in the filling department of Messrs. C. Shippam, Ltd.

Marketing Spirit Vinegar

Mr. Philip Denham has been appointed to market in Southern England Messrs. British Vinegars', Ltd., new product Spirit Vinegar which is rapidly gaining ground among manufacturers as a valuable alternative to synthetic acetic acid.

* * *

The Vitameter

The rapid determination of the vitamin A content of fish-liver oil is, according to the makers, Adam Hilger, Ltd., made possible by their apparatus.

The sample of oil is dissolved (usually in cyclo-hexane or alcohol) to produce a known concentration, and placed in a vita-glass cell inside the vitameter. A small metallic arc lamp is lit and the operator looks into a hood on the front of the vitameter. There he sees two narrow patches of light, beside one another, one of which is less bright than the other. A small lever with index projects from the point of the vitameter, and by moving this he brings both patches to the same brightness.

A scale associated with the index gives a reading, and this reading multiplied by 1,600 gives the vitamin A content of the solution in international units per gramme.

* * *

A.R.P. Plant

The necessity of effective purification from poisonous gases of the air used in the ventilation of Air Raid Shelters has been realised by Messrs. Ozonair, Ltd.

Gas filtration plant for this specific purpose is now being produced by this firm according to Government specifications.

For over 30 years, Messrs. Ozonair, Ltd., has devoted its energies to the manufacture of plant designed for this purpose and now claims that such a plant as they have been able to produce for this vitally important object will embody all possible means for the collection or occlusion of these poisonous gases.

The plant is designed in the form of a self-contained unit which will remove all toxic and irritant impurities from the air. It is simple to handle and almost impossible to get out of order or fail at the crucial moment of need.

* * *

Britain to Exhibit at Rome

The Department of Overseas Trade announce that the British Government in the United Kingdom have accepted the invitation of the Italian Government to participate in the Rome Universal Exhibition in 1942.

British Association of Chemists

Professor J. B. S. Haldane, F.R.S. (Professor of Biochemistry, University College), will address the London Section, British Association of Chemists, on "Heredity, Chemistry and Politics" at the Conway Hall, Red Lion Square, W.C. 1 (near Holborn Tube), at 8 p.m. on Tuesday, March 14. Members of other professional chemical organisations are cordially invited.

* * *

"Oilite" Saves Time and Labour

The far-reaching possibilities of "Oilite" self-lubricating bronze bearings is interestingly outlined in a brochure issued by the Manganese Bronze and Brass Co., Ltd., Handford Works, Ipswich, Suffolk.

"Oilite" self-lubricating bronze bearings are adapted for a wide range of applications throughout the engineering and allied industries, since they not only possess the qualities of strength, ductility and freedom from brittleness, but have, in addition, the property of supplying lubricant to the journal at the rate called for by the speed, load and general running conditions.

"Oilite" is a porous bronze material impregnated with lubricating oil of appropriate quality in such a manner that the pores within the metal act as an oil reservoir and at the same time deliver a continuous film of oil to the bearing surface by a combination of capillary and syphonic action.

Some of the many advantages derived from the "Oilite" bearing are that no oiling or attention is required during service; no lubricators or oil pipes are needed—an important saving in cost—and it eliminates all oil grooves within the bearing.

* * *

Change of Address

Owing to the general expansion of trade which has taken place during the past few years in regard to the extended business operations of both Hiron and Rempler, Ltd., and Alka, Ltd., it has now been found necessary to obtain additional factory and office accommodation for the first-mentioned company.

Messrs. Hiron and Rempler, Ltd., have obtained a suitable building site within close proximity and situated near to Stonebridge Park Station (Bakerloo Railway), where a modern factory is in the course of erection.

The new factory will be occupied solely by this company and occupation will be taken up on March 15, 1939, after which date all communications should be addressed as follows: Hiron and Rempler, Ltd., Dairy Engineers, Heather Park Drive, Wembley, Middlesex. Telephone No. Wembley 4424 (2 lines).

* * *

Vegetable Oils and Oilseeds

Some idea of the importance of the commodities dealt with in *Vegetable Oils and Oilseeds*, an annual review just issued by the Imperial Economic Committee, is given by figures of world exports.

In 1937 the oilseed-producing countries exported more than 10 million tons of oilseeds and nuts, besides well over one million tons of vegetable oils. In India and many of the British Colonies the various oilseeds and vegetable oils, besides figuring prominently in the export trade, provide an important item in the local food supply. World trade in oilseeds and vegetable oils showed a considerable expansion in 1937, according to the review, the increase being most notable for linseed, groundnuts and coconut oil.

The chief countries importing oilseeds are the United States, Germany, the United Kingdom, France and Italy, ranking in that order according to the quantities of vegetable oils used. In the United Kingdom the available supplies of vegetable oils showed a steady advance from the low point of 1933, reaching in 1937 the high figure of 582,000 tons.

Supplies of vegetable oils in the United States reached a record total in 1937, chiefly as the result of an increase in the quantities of cottonseed oil available. In Germany the available supply of drying oils continued in 1937 the fairly steady decline which has gone on since 1932, while supplies of the other industrial and edible oils were large in 1937 by comparison with the small total recorded in 1935, but below the total for 1936. The outstanding feature of the French supplies is the predominance of groundnut oil, and the large quantities of that oil which were available in 1936 and 1937 considerably increased the total quantities of vegetable oil supplies. In Italy the size of the domestic production of olive oil largely determines the quantities of other vegetable oils required in the ensuing year. The olive crop was poor in 1936, so that in 1937 imports of groundnuts were much increased, but later in the year a good olive crop was harvested.

The United Kingdom consumption of oils and fats for margarine production rose slightly to a total of 161,000 tons in 1937, continuing the gradual recovery which had been in progress since 1934. For some years a tendency to use a larger proportion of whale oil in margarine was evident, and it now accounts for about two-fifths of all oils and fats used. This movement, which took place at the expense of the vegetable oils, was checked in 1937. The use of groundnut oil sharply increased and it displaced coconut oil as the chief vegetable oil used. In the United States, where vegetable oils are by far the chief ingredient, there was a very slight rise in 1937 in the quantities of oils and fats used.

For most oilseeds and vegetable oils prices were at a comparatively high level at the beginning of 1937; between January and March, however, prices began to decline. The fall continued during 1938, though in general it was less severe than it had been in the previous year.

OBITUARY

Mr. E. R. Bolton

Mr. Edward Richards Bolton, F.I.C., M.I.Chem.E., F.C.S., analyst and consulting chemist, managing director of Technical Research Works, Ltd., and a member of the Delegacy and a Fellow of the University of London, died suddenly on February 10. The funeral took place on February 14 at Golders Green.

A well-known man who, during his distinguished career, has held some of the highest offices connected with his profession, Mr. Bolton was born in 1878, the only son of Mr. J. A. Bolton, of Blackrock, Co. Dublin. He was educated at Bedford and at King's College, London. From 1915 to 1925 he was Honorary Secretary of the Society of Public Analysts, and from 1926 to 1928 he was President of the Society. From 1925 to 1928 he was also Vice-President of the Society of Chemical Industry of Great Britain and Ireland.

As an authority on fertilisers and feeding stuffs Mr. Bolton served as a member of the Advisory Committee on that subject. From 1927 to 1929 he was a member of the Council of the Chemical Society, and he was Vice-President of the Medico-Legal Society of London from 1931 to 1933. In addition to these numerous activities, Mr. Bolton gave valuable service to the Imperial Institute as a member of the Advisory Council on Plant and Animal Products, as Chairman of the Committee on Oils and Oil Seeds, and as Chairman of the Sub-Committee on Tung Oil. The British Standards Institution had his co-operation as a member of the General Council and as a Chairman of the Committee on Vegetable Oils.

Among his publications were *Oils, Fats and Fatty Foods: Their Practical Examination*, and *Oils, Fats, Waxes and Resins*, of which he was joint author.

INFORMATION AND ADVICE

Mildew on Jam — Grapefruit Marmalade — Scum on Piccalilli — Pickled Vegetables in Sauce — Christmas Pudding Recipe — Cocoa Butter Manufacturers — Slicing Candied Peels — Jams for the Bakehouse

Mildew on Jam

4,848. *I am troubled with mildew coming on jam when it has been a few weeks made, and as I have had quantities returned to my factory I would be glad to have your advice as to the best means of having this trouble prevented.* (Waterford.)

Mould on jam may be caused by several factors. The jam should be stored in a dry atmosphere at about 60° F., the lower the temperature the better. But even under such conditions mould may develop through incorrect preparation. Moulds tend to increase as the sugar concentration falls. The percentage of soluble solids should be about 72 per cent. when the acidity is normal. The most practical way to test this is by means of a refractometer.

The jam from the boiling pan almost certainly does not contain living mould spores, yet each jar filled becomes infected from the air. For this reason jam should be covered quickly and the filling and packing room should be kept as clean and hygienic as possible. Other practical steps are by using hermetically sealed tops and sterilising or by using freely permeable closures such as parchment without sterilising.

The sterilisation may be done by filling the jam at 190° F. to 200° F., closing immediately and inverting the jars for three or four minutes, or it may be done in a steam steriliser. It may not be possible to close the jars with metal tops on account of cost, in which case parchment tie-over covers are best. They are permeable to air and water vapour. When stored in a dry atmosphere the water vapour from the jam passes through and no condensation occurs. In humid weather water vapour may pass through and be absorbed by the jam, thus reducing the concentration of the soluble extract on the surface layer and so cause moulding. But if the humid conditions do not prevail too long this vapour can pass through the cover and no harm will result to the jam. If covers are used which are impermeable to water vapour, condensation on the inside will occur, and mould growth will appear.

Grapefruit Marmalade

4,653. *Would you let us have a recipe for grapefruit marmalade.* (London.)

6 grapefruits (each 10 to 12 ozs.)
½ oz. tartaric acid
8 medium-sized lemons
9 quarts water
10 lb. sugar

Wash fruit thoroughly. Cut in half and squeeze out juice. Shred the pith and rind thinly, but throw away cores and pips. Put prepared rind and pith, juice, tartaric acid and water into large pan or bowl. The next day, boil in preserving pan slowly until contents are reduced by half. This will take about three hours. Add sugar and stir while bringing to boil. Boil for ten minutes or until it jells when tested (about ten to twenty minutes). Pot and cover as usual.

Scum on Piccalilli

4,752. *We know that the reason for scum forming on top of piccalilli sometimes after a few days usually depends on the condition of customers' shops, warmth or atmospheric conditions. In our case, however, we consider there is brine arising from the vegetables. Can you offer a remedy, please?* (Brighton.)

The first step in the solution of your problem is to ascertain the composition of the scum, and we suggest you submit a sample to an analyst. We have no facilities at this office for such work, but we should be pleased to recommend someone who could do this analysis for you.

Pickled Vegetables in Sauce

4,645. *There is an English product called "Captain Cook" pickles. It is manufactured with vegetables with a brown sauce. While not wishing to get information regarding their particular recipe, could you kindly give us a recipe for a similar pickle.* (Victoria.)

We have no recipe for the particular type of pickle you mention, but the following is a recipe for a fruit sauce, which might be used as a basis for experiment, and the various pickled vegetables incorporated afterwards. The degree of thickening desired can be obtained by using wheat flour, cornflour, sago or arrowroot, or mixtures of these. Vegetable gums are also much used as thickeners, but the finished sauce should be cooled quickly to prevent breakdown:

Dates	15 lb.
Tomatoes	10 ,,
Raw onions, chopped	18 ,,
Garlic, chopped	2 ,,
Tamarinds	5 ,,
Orange marmalade	14 ,,
Apple pulp	2 gal.
Soy	½ ,,
"16" vinegar	24 ,,
Lemons, cut up	30
Ground ginger	1 lb.
Cayenne	½ ,,
Nutmeg, ground	½ ,,
Mace, ground	½ ,,

Christmas Pudding Recipe

4,940. *Are you in a position to provide us with any information regarding the manufacture and processing of Christmas Puddings? We are interested in the production of first quality puddings of high-class trade and also for a cheaper type of pudding suitable for more popular demand. In particular we should appreciate any guidance which you can give us about the packing of Christmas Puddings in hermetically sealed tins, and also, in the case of the cheap puddings, the packing of them in some kind of greaseproof or waxed cardboard containers without bowls or tins.* (Grimsby.)

It is, of course, more satisfactory for a manufacturer to evolve recipes in accordance with his estimate of the market, but this will give you a basis for experiment.

Christmas Pudding, Fancy Grade.

20 lb. currants.
20 lb. seeded Muscatel raisins.
20 lb. suet.
15 lb. bread crumbs.
5 lb. sugar.
2 lb. candied lemon peel.
5 lb. candied orange peel.
5 lb. flour.
¼ lb. powdered nutmegs.
8 doz. eggs.
6 gal. brandy.

Christmas Pudding.

20 lb. suet.
20 lb. currants.
16 lb. flour.
10 lb. bread crumbs.
20 pints molasses.
5 oz. tartaric acid.
20 pints apple pulp.
½ lb. salt.
4 oz. ground Saigon cinnamon.
4 oz. baking soda.

Pack into cans, seal, and process as follows:

¼-lb. cans	.. ..	1½ hours
½-lb. ,,	.. ..	2 ,,
1-lb. ,,	.. ..	2½ ,,
2-lb. ,,	.. ..	3 ,,
4-lb. ,,	.. ..	4 ,,

at 240° F.

The mix should be weighed into the cans, covered with greaseproof paper, and passed to the steamer—a chamber in which a temperature of 212° F. can be maintained for one to two hours. This steaming process is necessary before clinching the heads to prevent undue strain on the seams and the melting of the sealing compound. Steps should be taken to prevent water of condensation drifting on to the puddings, and the chamber should be at a high temperature before they are put inside. The cans should be passed to the seamer for closing as soon as possible after leaving the steamer.

For packing in other types of containers the mix should be weighed on to greaseproof paper, folded double, slightly damp, and dusted with flour. The corners should be tied with thread and cooking carried out in a steamer or boiler. After cooking, the puddings should be hung to dry, then packed as desired.

Cocoa Butter Manufacturers

4,689. *We have received an enquiry for the name and address of a firm in Watford who are understood to have recently begun the manufacture of cocoa butter. We wonder whether you have any note of this and could kindly give us the name of this firm.* (London.)

We have been unable to discover a new firm in Watford manufacturing cocoa butter, but are continuing our enquiries.

Slicing Candied Peels

4,790. *Will you advise us on the complete process of slicing candied peels. Will it be preferable to do candying before the peels are sliced?* (India.)

In this country it is usual to candy the peels in halves. The fresh peels (which should be cup-shaped) are first treated with a brine solution containing 1½ lb. salt to 1 gal. of water. After several weeks the peel is removed and drained and rinsed in water. Finally, the peels are heated to about 110° F. in three or four changes of fresh water in order to remove the last traces of salt. The skins are drained again on a wire gauze and then packed carefully, one inside the other, into a tank containing sugar syrup of 18° Brix. strength. After twenty-four hours this syrup is run off and more sugar added to it to build up to 35° Brix. This syrup is then used to cover the peel for a further twenty-four hours, after which the same process is repeated at a strength of 45° Brix. It is again repeated at a strength of 52° Brix., all these syrups being poured on boiling hot. Finally, the peels are drained on wire trays and dried in a properly ventilated room at about 120° F. for twelve hours.

Jams for the Bakehouse

4,922. *We have for a long time been coming up against jams of a very low quality and exceptionally low price, such as raspberry, raspberry and apple, raspberry flavour, etc., and we are wondering if it is permissible for jams of a lower standard than the original Lower Fruit Standard to be sold to the bakery trade—for use in the bakehouse only.* (Manchester.)

The Food Manufacturers' Federation published, in 1930, the text of an agreement which had been arrived at with the Society of Public Analysts establishing voluntary standards of quality for jams. This agreement covered the jams supplied to the bakery trade, and it can only be that the local authorities are less vigilant in this direction that such firms as you refer to are able to supply low quality jams without penalty.

World copyright in this feature is fully reserved. No extracts without permission.

RECENT PATENTS

These particulars of new patents of interest to readers have been selected from the "Official Journal of Patents", and are published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

Abstracts of Recent Specifications

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume, or in bound volumes price 2s. each.

Food Fats

Dispersing agents for use in the manufacture of margarine or shortenings of the water-in-oil type and for the manufacture of oil-in-water dispersions are prepared by combining a polyglycerol with a polymerised higher fatty acid by esterification or re-esterification of the polyglycerol with polymerised higher fatty acids or their esters, or with unsaturated higher fatty acids or their esters, in which latter case the esterification is followed by polymerisation. The polymerised fatty acids may also be oxidised before or after esterification. Non-polymerised and non-oxidised fatty acids may also be present during the combination of the polymerised fatty acids. In examples: (1) glycerol is converted into polyglycerol by heating in the presence of sodium acetate and an inert gas, the product heated with soya oil, the product then polymerised and oxidised, and the final product, mixed with molten cotton, seed oil and coconut oil, has skim milk, bacterially acidified, dispersed in it to yield, after cooling and plastifying, a margarine; (2) hydroxyl containing esters in the dispersing agent made according to example 1 are removed by treatment with ethyl alcohol and used alone as dispersing agents; (3) polyglycerol is heated with the dispersing agent prepared according to Specification 187,298 (Class 91); (4) the fatty acids derived from the undiluted, gelatinised, polymerised and oxidised soya oil (Specification 187, 299 [Class 81 (i)]) are esterified with polyglycerol.

494,639. Schou, H.

Cheese: Double Salts

Crustless cheese is prepared by fusing hard or soft cheese with a melting salt consisting of a fused mixture of alkali metal orthophosphates with calcium salts or calcium oxide, the fused mixture being free from water of constitution. Known melting salts—*e.g.*, alkali metal ortho- or pyrophosphates or salts of edible organic acids—may be added to this melting salt. In an example the melting salt is prepared by heating sodium dihydrogen orthophosphate and calcium oxide or a calcium salt—*e.g.*, calcium carbonate—up to the point of quiescent fusion at about 700° to 900° C. The potassium may replace the sodium phosphates. All water of constitution escapes during the heating, and the complex calcium-alkali metal phosphates formed are finely ground for use with the cheese. The salts may be adjusted to a desired *p*H range, determined in aqueous solution, by varying their composition—*e.g.*, made more alkaline by adding in the melt more sodium monohydrogen orthophosphate or soda—or by mixing the melting salt with other phosphates—*e.g.*, tetrasodium pyrophosphate. A higher melting temperature, 80° to 90° C., may be employed for the cheese, even with fat-rich varieties such as Emmenthal, Gorgonzola or Cheddar. Specification 378,918 is referred to.

494,911. Dubbers, H.

Removing Water from Dextrose Hydrate

The water of crystallisation is removed from dextrose hydrate as by heating to 160° to 200° F., the material being then ground to give a soft, non-gritty powder which may be mixed with an edible fat and other desired ingredients to produce a food compound. In examples: (1) a chocolate covering comprises hard vegetable butter or other fat, cocoa, dry skim milk, sucrose, the dextrose, salt, and vanillin; (2) a white hard butter coating comprises hard butter, the dextrose, salt, and vanillin; (3) a sandwich filling comprises soft butter, dry skim milk, sucrose, the dextrose, salt, and vanillin. Specifications 227,140 and 232,160 (both in Class 127) are referred to.

493,005. International Patents Development Co.

Food Preparations

In packing meat, including butcher's meat, poultry, game and fish, in sealed containers, meat is finely divided, mixed with farinaceous material—*e.g.*, potato or other flour, or bread, rusks, etc.—and the mixture cooked, allowed to cool and divided into pieces or slices of substantial size which are filled into a container together with pieces or slices of other meat similarly prepared, or with coarsely chopped or sliced meat of the same or different kind. The container is then heated to processing temperature, causing the pieces of meat to unite to a coherent body, the container being sealed before, during or after the processing. Gelatine or other liquid which sets on cooling may be added to fill up spaces in the container. A compound roll may be obtained by employing the pieces of the prepared finely divided meat as lining in the container, which is then filled with the coarsely chopped or sliced meat which forms the core, or conversely. The core or shell of finely divided meat may be formed of discrete portions prepared from different kinds of meat. An additional shell or shells of finely divided meat of another kind or kinds may be inserted between the shell and the core. The shell may not completely surround the core. In preparing the finely divided meat there may be added, besides the farinaceous material, setting agents such as gelatine, seasonings, including spices, herbs, onions, tomatoes or eggs, and edible colouring matters. Each meat used may be associated with a suitable flavouring material—*e.g.*, pork with sage and onions, beef with tomato, and lamb with peas. Specifications 341,760, 377,766, 435,373 and 442,644 are referred to.

495,206. Vickers, H.

Tea

A tea which has been freed from caffeine is treated with albumen, formaldehyde or a non-poisonous metal salt such as aluminium lactate, to combine with the tannin, which was originally combined with the caffeine.

495,109. Grethe, T.

Latest Patent Applications

2342. ZUNKER, F.: Production of a nutrient, etc., from grasses, etc. January 23.

2319. GROSZ, L.: Making malt, etc. January 23.

2198. THORSTEINSSON, A.: Method of producing dried materials from fresh animal tissue. January 21.

2138. FUSSELL, J. G.: Means for controlling the temperature of foods, etc. January 21.

1881. LANCASHIRE DYNAMO AND CRYPTO, LTD., and WILSON, E. P.: Sausage-filling machines. January 19.

1504. FAWCETT, E. W., and IMPERIAL CHEMICAL INDUSTRIES, LTD.: Production of valuable substances from fats, etc. January 16.

1151. HUTCHEON, J.: Method of purifying tea, etc. January 13.

1072. REICH, E.: Method, etc., of preparing food. January 12.

786. GALVIN, H. D.: Treatment of condensed, etc., milk. January 10.

483. NAAMLOOZE VENNOOTSCHAP W. A. SCHOLTEN'S AARDAPPELMEELFABRIEKEN: Method of producing foodstuffs. January 6.

Complete Specifications Accepted

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

499,204. HEIKKILA, A.: Devices for the keeping of cheese and other foodstuffs and for facilitating the slicing thereof.

499,059. STANDARD BRANDS, INC.: Process for the manufacture of extracts of egg yolk, and for the production of baked goods therefrom.

498,620. POLUZZI, R.: Apparatus for washing fruits or vegetables. (Cognate application 27952/37.)

498,305. REAVELL, J. A.: Concentration of fruit juices and similar liquors.

498,197. JONES, C. R., and FISHER, E. A.: Method of dressing floury stocks.

NEW COMPANIES

Associated British Milk Carriers, Ltd. (348,537.) January 18, 1939. To carry on the bus. of carriers; to promote the interest of persons engaged in the haulage of milk by road, etc. Dirs.: To be appointed by the subs.

T. Clegg and Son (Sunderland), Ltd. (348,844.) January 25. Mineral water mnfrs., bottlers and dlrs. £3,000. Dirs.: T. Clegg, Mrs. J. Clegg, and T. G. Clegg, all of 9, Farnham Terrace, Sunderland.

Harper's Home-Made Cakes, Ltd. (348,665.) January 20. 310, Earls Court Road, London, S.W. 5. Bakers, confectioners, etc. £1,000. Dirs.: D. L. L. Humphries, 32, Arlington Court, Arlington Road, Twickenham Park, Middlesex; Mrs. M. Hoar, 306, Earls Court Road, London, S.W. 6.

Keith Spicer, Ltd. (348,565.) January 18. Mnfrs. of and dlrs. in tea, coffee and cocoa; bakers, etc. £3,000. Dirs.: H. Keith Spicer, 86, Harewood Avenue, Boscombe; W. A. Horrocks, 123, Harewood Avenue, Boscombe, Bournemouth.

Keyes Egg Tray Sales, Ltd. (348,359.) January 12. 21, Cole Street, S.E. 1. Dlrs. in trays or receptacles made of pulp, wood, cardboard or other material for containing and packing eggs or other produce, etc. £1,000. Dirs.: F. R. Best, Boxmore Lodge, Lurgan, Northern Ireland; H. Sparks, 16, Great Dover Street, S.E. 1; J. B. Merrett, 102, Denbigh Road, S.W. 1; R. H. Storey, 186, Nevill Road, Hove, Sussex.

Lillywhite's Dairies, Ltd. (348,362.) January 12. Dairymen. £5,000. Dirs.: H. M. Lillywhite and Mrs. A. K. Lillywhite, 20, Sheet Street, Windsor.

O.P. Chocolate Specialities (Manufacturers), Ltd. (348,212.) January 7. Mnfrs. of and dlrs. in chocolate, sweets, confectioneries, etc. £4,000. Dirs.: To be appointed by the subs.

Palace Rock Co., Ltd. (348,278.) January 9. Mnfrs. of and dlrs. in confectionery, etc. £1,000. Dir.: J. L. Walton, 449, Promenade, Blackpool.

Pollock and Co., Ltd. (348,340.) January 11. 1, London Bridge, S.E. 1. Mnfrs. and producers of and dlrs. in butter, margarine, fats, bacon, dairy, farm and garden produce, etc. £12,000. Permt. dirs.: F. S. E. W. Warren, 99, Foxgrove Road, Beckenham; C. E. Christensen, Ingersvej, 11, Charlottenlund, Denmark; J. Stacey, 418, Whirlewdale Road, Sheffield, 11; S. S. Holland, 26, Hayes Chase, West Wickham, Kent.

Scott's Minerals (London), Ltd. (348,293.) January 7. 6-12, Eden Road, Walthamstow, E. 17. Mnfrs. of and dlrs. in minerals and aerated waters, etc. £2,500. Life dir.: C. C. Savage, 38, David Drive, Harold Park.

Showsales, Ltd. (348,804.) January 24. Mnfrs. of and dlrs. in confectionery, etc. £1,000. Permt. dirs.: C. W. Baker, Mrs. F. B. Baker, 15, Worcester Road, Woodthorpe, Nottingham.

Sweets and Biscuits, Ltd. (348,450.) January 14. Mnfrs. of and dlrs. in biscuits, cakes, sweetstuffs, etc. £1,000. Dirs.: To be appointed by the subs.

T. S. and D. Thirsk, Ltd. (348,415.) January 13. Millers. £40,000. Dirs.: D. Thirsk, Westwood, South Cliff, Bridlington; H. S. Thirsk, The Groves Farm, Pocklington; T. J. Thirsk, E. S. Thirsk and W. McGloon.

Vebrin, Ltd. (347,854.) December 30. 64, Mark Lane, London, E.C. 3. Dlrs. in brined vegetables, etc. £5,000. Dirs.: W. Spyer, T. Spyer.

White Brothers (Derby), Ltd. (347,054.) December 7. 80-2, Havelock Road, Derby. Mnfrs. of and dlrs. in mineral and aerated waters, fruit juices, etc. £5,000. Dir.: E. White.

Wood's Bacon Factory, Ltd. (347,904.) December 31. Ham and bacon curers, etc. £5,000. Permt. Managing Dir.: G. Wood, Healds House, Heald Road, Dewsbury.

G. Wright and Son (Dorchester), Ltd. (348,006.) January 3, 1939. Wholesale and retail grocers and provision mchts. £20,000. Permt. Dirs.: A. D. Wright, Stauros, Kings Road, Dorchester; R. R. Wright and D. N. Wright, White Gates, Treves Road, Dorchester.

The above-mentioned particulars of new companies registered are taken from the Daily Register compiled by Jordan and Sons, Ltd.

TRADE MARKS

ANGLAS.—602,624. **Cocoa butter.** The Anglo-Asiatic Co., Ltd., 23-26, St. Dunstan's Hill, London, E.C. 3. (Associated.) February 1.

BENCRISP.—603,388. **Edible oils and edible fats.** Benninga (Mitcham), Ltd., 33, Mortimer Road, Mitcham, Surrey. (Associated.) January 25.

BESPRO. — 602,748. **Preparations of cereals and soya flour for use as food.** British Soya Products, Ltd., The Mill, Standon, Hertfordshire. January 25.

BETTY'S.—602,881. **Confectionery.** Old Betty Plants's, Ltd., The Toffee Works, Morley Street, Hanley, Stoke-on-Trent. (By Consent.) January 25.

COCOVITA.—602,058. **Biscuits containing cocoa (not being food for animals).** Broadhurst and Co. (Gadbrook), Ltd., Gadbrook Biscuit and Cake Factory, Gadbrook, Northwich. (By Consent.) January 18.

ERA-ERA.—603,149. **Seaweed extracts for food.** Campbell Industries, Ltd., Hibernia Chambers, London Bridge, London, S.E. 1. January 25.

GOLDEN BUTTERFLY. — 602,331. **Cream, cheese, condensed, skimmed, evaporated and sterilised milk, and preparations consisting principally of condensed milk, cream or cheese for use as food or as ingredients in food.** Fussell and Co., Ltd., 6 and 8, Eastcheap, London, E.C. 3. (Associated.) January 18.

HALSITABS.—603,200. **Sweetmeats in tablet form.** J. W. Thornton, Ltd., 1, London Road, Sheffield, 2; and Thornton's Chocolate Works, Archer Road, Sheffield, 8. (Associated.) January 25.

HISTORIC.—602,889. **Chocolates.** C. Kunzle, Ltd., 156, Broad Street, Birmingham, 15. January 25.

KIA-ORA.—603,236. **Preserved, canned and bottled fruits and vegetables, jams, jellies (for food), marmalade, and fruit and vegetable preserves, all being goods for export.** Kia-Ora, Ltd., 35 to 38, Rushworth Street, Blackfriars, London, S.E. 1. (Associated.) February 1.

KNOBS. — 602,197. **Fresh herrings.** Crosse and Blackwell (Manufacturing Co.), Ltd., 20, Soho Square, London, W. 1. February 1.

PENNIES FROM HEAVEN.—603,246. **Confectionery.** Batger and Co., Ltd., Brook Street, Ratcliff, London, E. 1. January 25.

RUSACS.—603,337. **Flour, bread, cakes and biscuits (not being food for animals).** Edgar J. Saxon, Ltd., 314, Uxbridge Road, London, W. 3. January 25.

WHITE FLAME.—600,669. **Edible fats and eggs.** I. Beer and Sons, Ltd., 15, King Street, West Smithfield, London, E.C. 1. December 14.

YOGFRUIT.—602,846. **Milk products (for food) containing fruit or fruit flavourings.** Yogfruit Erat, Ltd., 19, Colindale Avenue, London, N.W. 9. January 4.

ZESS.—601,321. **Fruit beverages (not alcoholic).** O. R. Groves, Ltd., 32, Shaftesbury Avenue, London, W. 1. December 14.

This list of trade marks of interest to readers has been selected from the "Official Trade Marks Journal", and is published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

PFAUDLER glass lined percolator for extracts

The Pfaudler Glass Lined Pre-Vak Percolator meets the demand for an efficient machine that will produce first-class vanilla and similar extracts quickly and economically. Operating on the pressure-vacuum principle it reduces the time necessary for thorough extraction. Being of closed construction it prevents losses due to evaporation. The glass lining allows the percolate to retain its natural flavour and may be so thoroughly cleaned as to permit the machine to be used for a totally different product if so desired. Metallic contamination is minimised and the high quality of the finished product ensured. Fuller details of this machine will be found in our catalogue, F.P.15. We should be glad to forward a copy on request.

ENAMELLED METAL PRODUCTS CORPN. (1933) LTD.
Artillery House Artillery Row London, S.W.1
Telephone : ABBey 2121 (6 lines) Works: Leven, Fife

EXPORT DIVISION
INTERNATIONAL PFAUDLER LTD.
9, Artillery Row, London, S.W.1
ENGLAND

PFAUDLER *glass-lined steel* EQUIPMENT

GELATINES
OF ALL KINDS

IMPORTERS & DEALERS IN

ALMONDS (Bags & Boxes)	DESICCATED COCOANUT	GLACÉ CHERRIES
WALNUTS	AGAR-AGAR	TARTARIC ACID
BRAZILS (Shelled)	GUM ARABIC	CITRIC ACID
HAZELNUTS	GINGER (Wet & Dry)	FARINA
PEANUTS	COCOA BUTTER	SAGO FLOUR (& Dressed)
	ALBUMEN	MAIZE FLAKES
		SUGAR CANDY Etc.

FOUNDED IN 1857

Registered Trade Mark — DLF — Registered Trade Mark — FORCE et DOUCEUR

T. M. DUCHÉ & SONS [U.K] LTD

Telephone: Mansion House 7681 (3 lines)

Telegrams: "Duché, London"

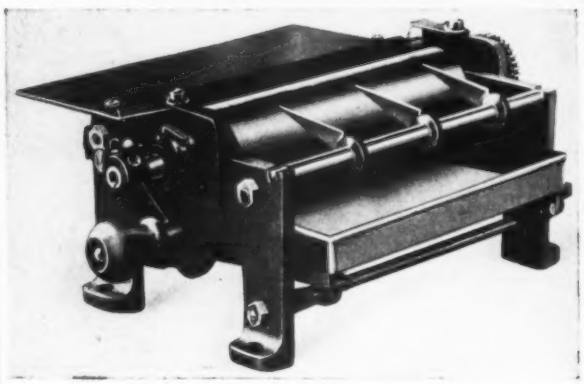
ADELAIDE HOUSE, KING WILLIAM ST., LONDON, E.C. 4

BRANCHES AT

MANCHESTER: 5 Marsden St. *Telephone:* Blackfriars 4862 (2 lines). **GLASGOW:** 28 Cadogan St. *Telephone:* Central 6498 (2 lines)

LABELLING

IS SIMPLIFIED
IF THE GUMMING IS DONE ON A
"ST. GEORGE" MACHINE



THE MACHINE THAT IS
A LITTLE BETTER—
A LITTLE CHEAPER

PRACTICAL MACHINES CO.
(A. T. GADSBY) LTD.
46 Camberwell Green, LONDON, S.E.5

Pulping Machines

Pulping is an operation for which Monel* is peculiarly suitable, for it usually involves the combination of mechanical strain and corrosion. Most products which require to be pulped are of acid character and for the equipment employed — screens, containers, hoppers, covers, shafts, etc.—Monel is regularly employed. Tomatoes, pumpkins, cranberries and apples are some of the products handled.

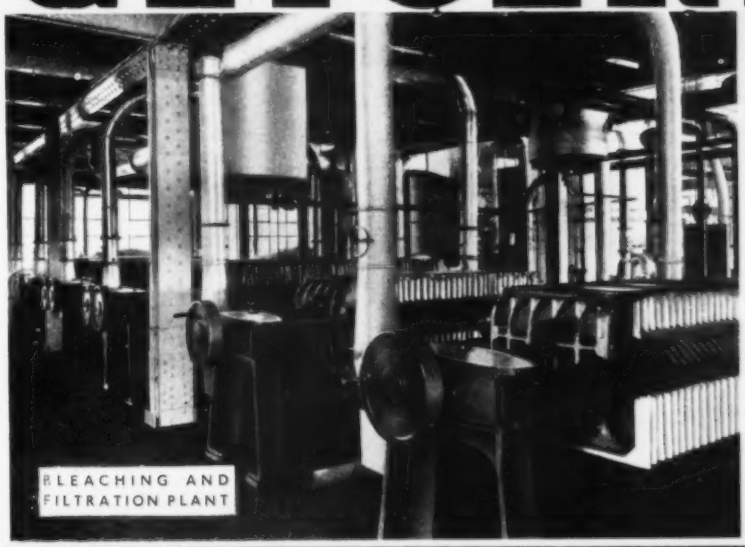
An extract from our publication on Food Manufacturing Equipment.

Z

See advertisement of
HENRY WIGGIN & CO. LTD.
page lv

* "Monel" is a registered trade-mark.

GLYCERINE



The Purest Quality on the Market

Chemically Pure B.P.
• Pale Straw •

Produced by
THOMAS HEDLEY
& COMPANY, LTD.
TRAFFORD PARK,
MANCHESTER.

Sole Distributors:
FREDK. BOEHM, LTD., 17, JEWRY ST., LONDON, E.C.3
and 140 WEST GEORGE STREET, GLASGOW

WE INVITE YOU!

TO CONSIDER THE MERITS OF

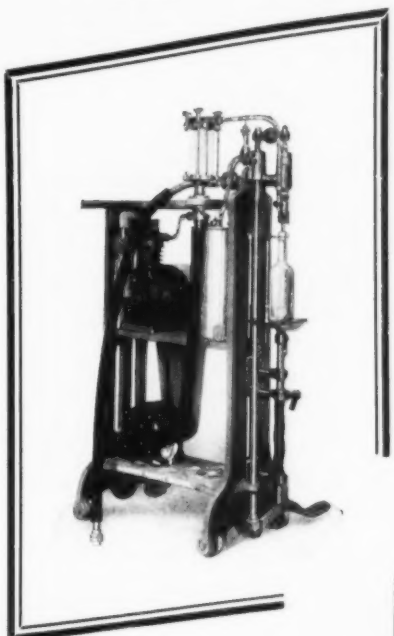
ROBERTS PATENT VACUUM BOTTLE FILLERS

SINGLE, DOUBLE, AND TRIPLE HEAD MACHINES

LOW COST AND UPKEEP

HIGH OUTPUT AND EFFICIENCY

SELF-CONTAINED AND COMPLETE PORTABLE UNITS FOR ALL LIQUIDS



CLEAN AND RAPID FILLING. NO WASTE. EASY TO OPERATE

OUR TECHNICAL STAFF IS AT YOUR SERVICE

WE SOLICIT YOUR ENQUIRIES

ROBERTS PATENT FILLING MACHINE CO. Ltd.
BOLTON, Eng.

Phone : 661. **Grams : Filling, Bolton**

GELOZONE
S.T.1.
STABILIZER

As a powerful stabilizer and suspending agent, Gelozone is definitely without equal, whilst it also has the valuable advantage of being absolutely pure. To the numerous products in which Gelozone is successfully used must now be added milk drinks. Manufacturers of these and similar beverages both at home and overseas are unanimous in declaring that Gelozone adequately satisfies all their requirements.

Beth Din has approved the use of Gelozone in Kosher products.

Details and prices of Gelozone gladly sent on request:

WHIFFEN & SONS LTD.
Carnwath Rd., London, S.W.6

TRY Gelozone TO DAY!

GAS-HEATED **RETORT**
& BOILER COMBINED

Experimental size for

MEAT
FISH
FRUIT
VEGETABLES

NO STEAM PIPE CONNECTIONS

"MILLWALL"

PRODUCTION BY

JOHN FRASER & SON, LTD.

ENGINEERS AND BOILER MAKERS

MILLWALL, LONDON, E.14 — *Phone:* EAST 1185 (Private Branch Exchange)

The 1939

FOOD INDUSTRIES MANUAL

is now ready!

In new and modern cover the 1939 edition of FOOD INDUSTRIES MANUAL, completely revised, gives you the very latest information on all aspects of food manufacture.

There is **no other book** containing such reference matter, in one volume, on food manufacture and production—recipes, tables, testing figures, temperatures, analysis, boiling points, machinery, storage, methods, economical systems, etc.

A complete and supremely useful compilation of essential tables, formulæ and data on food processes—of doubt-spelling accuracy.

Order your copy of this "volume of answers" at once—the facts it contains can be used in your own business; it is a time-saver, a money-saver—and a guard against mistakes.

Only 10/- post free

Publishers:

LEONARD HILL LIMITED
17 STRATFORD PLACE, LONDON, W.1
MAYFAIR 7383

ONLY A FEW

of the many headings!

INDEXES: Suppliers—Trade Names and Marks, etc. CEREALS: Wheat, Milling, Flour, Baking, Flour Confectionery; Acetic Acid, Analysis, Ash, Bacteriology of Wheat, Biscuits, Colloids, Garlic, Pests, Storage, Yeast and Fermentation, etc. CONFECTIONERY: Sugar Confectionery, Chocolate, Jams, Jellies; Cocoa, Caramel, Colours, Conches, Dextrose, Enrobers, Boiling, Heat Penetration, Lecithin, Liquorice, Melangeurs, Refiners, Thermometers, Vacuum Pans, etc. CANNING: A complete encyclopedia on the canning of Fruits, Vegetables, Meats, etc.; Acidity, Bacteria, Blanching, Can-closing Machines, Cloudiness, Cookers and Coolers, Corrosion, Gases, Lacquers, Moulds, Spoilage, Temperature, Vitamins, etc. MEAT PRODUCTS: Brine Tanks, By-Products from Glands, Casings, Curing, Essential Oils, Extract, Fillers, Flavourings, Gelatin, Glass Containers, Incubation, Preservation, Retorts, Salts, Storage, Water, etc. Formulæ and Figures for the DAIRY INDUSTRY: Composition of Milk, Adulteration, Butter Yield, Cheese, Government Standards for Dairy Produce, etc. PACKING: Including Packing Materials, Containers and Packing Machinery; Bags, Bundling Machines, Cardboard, Closures, Fibre and Paper Cans, Filling Machines for Bottles, Glass Containers, Ice-cream Packaging, Labelling Machines, Sealing Compounds, Wrapping Machines, etc. FOOD STORAGE & REFRIGERATION including Insulation and Air Conditioning; Ammonia, Brewing, Carbon Dioxide, Compressors, Condensers, Storage of Eggs, Storage of Fruit, Rapid Freezing, Thermometers, Vacuum Refrigeration, etc. The composition of FOODS: Tables giving Protein, Fat, Carbohydrate and Calorific Values. BOOKS: A section containing a full list of valuable reference books, dealing with all sides of the Food Industry.